JOURNAL OF PALEONTOLOGY

A Publication of
The Society of Economic Paleontologists and Mineralogists
A Division of the American Association of Petroleum Geologists
and
The Paleontological Society
An Associate of the Geological Society of America

VOLUME 12 MARCH, 1938 NUMBER 2

CONTENTS

PAGE

A Microfauna from the Vaqueros Formation, Lower Miocene, Simi Valley, Ventura County, California . . . . . *J. A. Cushman and L. W. LeRoy* 117

Miocene and Pliocene Ostracoda of the Genus *Cytheridea* from Florida . . . . . *Morton B. Stephenson* 127

Aturias from the Tertiary of Mexico *A. K. Miller and W. M. Furnish* 149

The Conodont Genus *Icriodus* and its Stratigraphic Distribution . . . . . *E. B. Branson and M. G. Mehl* 156

Triplalepidina veracruziana, a new Genus and Species of Orbitoidal Foraminifera from the Eocene of Mexico . . . . . *Thomas Wayland Vaughan and W. Storrs Cole* 167

Some Foraminifera of the Family Textulariidae from the Eocene of Cuba . . . . . *C. G. Lalicker and P. J. Bermúdez* 170

A New Family of Charophyta from the Lower Cretaceous of Texas . . . . . *Raymond E. Peck* 173

Bibliography and Index to New Genera, Species, and Varieties of Foraminifera for the Year 1935 . . . . *Hans E. Thalmann* 177

SOCIETY RECORDS AND ACTIVITIES

Members of the Society of Economic Paleontologists and Mineralogists 209

Notice to Fellows and Members of the Paleontological Society . . 215

ERRATA 215

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 117–126, PL. 22, 3 TEXT FIGS., MARCH, 1938

A MICROFAUNA FROM THE VAQUEROS FORMATION, LOWER MIOCENE, SIMI VALLEY, VENTURA COUNTY, CALIFORNIA

J. A. CUSHMAN AND L. W. LEROY

ABSTRACT

The bed, which is only a few feet thick and in which the Foraminifera were found, should be easily identified elsewhere. Twenty-one species and varieties of foraminifera were noted, four of which are described as new.

The assemblage of Foraminifera recorded in this paper is from a bed within the Vaqueros formation (lower Miocene) and from that part of the column commonly designated as the "*Turritella inezana* zone." The fact that this foraminiferal occurrence has a definite stratigraphic relationship to diagnostic Vaqueros molluscan zones, above and below, establishes it as one of special interest to paleontologists of the Pacific Coast.

W. S. W. Kew (1919, p. 331) has mapped and correlated the Vaqueros formation along South Oak Ridge.[1] Subsequent investigations of this same area by Wayne Loel and W. H. Corey (1932, correlation table) verified, in part, the original correlation. As a result of more recent studies, Corey (written communication) states:

> The Vaqueros formation exposed on South Oak Ridge contains a plentiful megafauna, many zones of which correlate directly with zones in the formation on the north side of Oak Ridge (designated on the U. S. Geol. Survey Camulos quadrangle; lies due north of South Oak Ridge) where they have been studied in more detail. The sequence and identity of zones indicate that a considerably greater time interval is represented by the South Oak Ridge section than by that of Oak Ridge proper.
>
> Inter-regional correlations indicate that the Vaqueros formation of Oak Ridge proper represents only the upper two-thirds of total Vaqueros time on the basis of an additional thickness of earlier strata. The South Oak Ridge section represents at least three-fourths of the total time interval occupied by the Vaqueros horizon (or stage) as correlated throughout California.

The Vaqueros formation outcrops on the north flank of the Simi anticline and along the south slope of South Oak Ridge between Happy Camp and Tapo canyons for a distance of about 9 miles. The width of the exposed thickness decreases eastward from Happy Camp Canyon as a result of overlap by the Modelo shale (upper Miocene). The upper 830 feet of the Vaqueros section in normal sequence is well shown in Spring Canyon. As a result of covering by terrace gravels, the lower 640 feet of the section is unexposed in this canyon but outcrops in Wood Canyon 1 mile east.

The upper faunal limit of the Vaqueros section in Spring Canyon is marked by a *Pecten magnolia* zone which has a thickness of 25 feet. West of the canyon this zone underlies an extrusive volcanic series; whereas to the east it rests nonconformably below massive-bedded, clean, gray, fine to coarse, nonfossiliferous sandstones.

The age assignment of these sandstones is not definite; however, because of their relative stratigraphic position in the column and evidence of angular discordance with the underlying Vaqueros, they are tentatively regarded as repre-

[1] South Oak Ridge is defined as the prominent ridge with even skyline that flanks the north side of Simi Valley between Happy Camp and Tapo canyons and lies south of and parallel to Oak Ridge proper, and south of the east-west trend of Happy Camp Canyon, U. S. Geol. Survey, Camulos quadrangle, Calif.

FIG. 1.—An airplane view showing the areal distribution of formations on the west end of South Oak Ridge, Ventura County, Calif. Scale 1 inch=1,500 feet.

senting a facies of the Topanga formation (middle Miocene), as mapped on the south side of the Simi Valley by Kew (1919, pp. 330–33).

The base of the Vaqueros in this region is rather indefinitely defined with reference to the underlying Sespe formation. The lower part of the section is represented by a series of massive, buff to gray sandstones which offer very little molluscan evidence. Within these sandstones, however, are several conspicuous zones of marine vertebrates, the lowest of which occurs about 50 feet stratigraphically above typical red clays, presumably of the Sespe formation (Eocene-Oligocene-Miocene?) (Stock, 1930, 1932 1932a). This point has been arbitrarily taken as marking the lower limit of possible marine beds and is, therefore, considered the lithologic base of the Vaqueros in this section.

The Vaqueros megafauna of South Oak Ridge has not been collected in sufficient detail to permit the preparation of a zonal check list. The following list compiled by W. H. Corey includes all known species from this area.

Fossils of the Vaqueros Formation of the South Oak Ridge Area

Pelecypoda

Anomia vaquerosensis Loel and Corey
Arca santaclarana Loel and Corey
Cardium vaquerosensis Arnold
Chione temblorensis subtemblorensis Loel and Corey
Clementia pertenuis (Gabb)
Diplodonta harfordi Anderson
Diplodonta cf. *orbella* Gould
Dosinia cf. *merriami* Clark
Lucina wattsi Loel and Corey
Macoma arctata (Conrad)
Macoma nasuta (Conrad)
Mactra cf. *sectoris* Anderson and Martin
Modiolus ynezianus Arnold
Ostrea eldridgei Arnold
Ostrea eldridgei ynezana Loel and Corey
Ostrea vaquerosensis Loel and Corey
Pecten andersoni subandersoni Loel and Corey
Pecten magnolia Conrad
Pecten sespeensis Arnold
Phacoides acutilineatus Conrad
Phacoides sanctaecrucis Arnold
Transennella (?) cf. *joaquinensis* Anderson and Martin

Gastropoda

Acteon sp.
Calyptraea filosa (Gabb)
Calyptraea inornata (Gabb)
Conus n. sp.?
Crepidula diminutiva Loel and Corey
Nassarius sp.
Olivella pedroana subpedroana Loel and Corey
Polinices recluzianus andersoni Clark
Rapana vaquerosensis (Arnold)
Rapana vaquerosensis imperialis Hertlein and Jordan
Terebra santana Loel and Corey
Turritella inezana Conrad s.s.
Turritella inezana sespeensis Arnold

Other Phyla

Bryozoa spp.
Balanus spp.
Scutella fairbanksi Arnold
Pinnipedia bones
Cetacea bones

FORAMINIFERAL LOCALITIES

Spring Canyon Locality: 2,400 feet south and 2,600 feet east of the intersection of W. longitude 118° 50′ and N. latitude 34° 20′, Piru quadrangle, U. S. Geol. Survey.

Deer Canyon Locality: 2,200 feet south and 1,700 feet east of the intersection of W longitude 118° 50′ and N latitude 34° 20′, Piru quadrangle, U. S. Geol. Survey.

FORAMINIFERAL ZONE

Corey (written communication) states:

The foraminiferal zone discussed in this paper occurs below and above many molluscan zones containing numerous proved Vaqueros index species, and is unquestionably of true Vaqueros age. Megafaunal correlations indicate definitely that this zone was deposited just prior to the last quarter of Vaqueros time.

The bed containing the Foraminifera has a uniform thickness of 10 feet between Spring and Deer canyons. It consists of a massive, bluish-gray, clay shale which is somewhat silty in the lower part. The foraminiferal zone occurs about 940 feet above the lithologic base of the Vaqueros. With reference to several major molluscan zones, it lies stratigraphically below *Pecten magnolia* (500

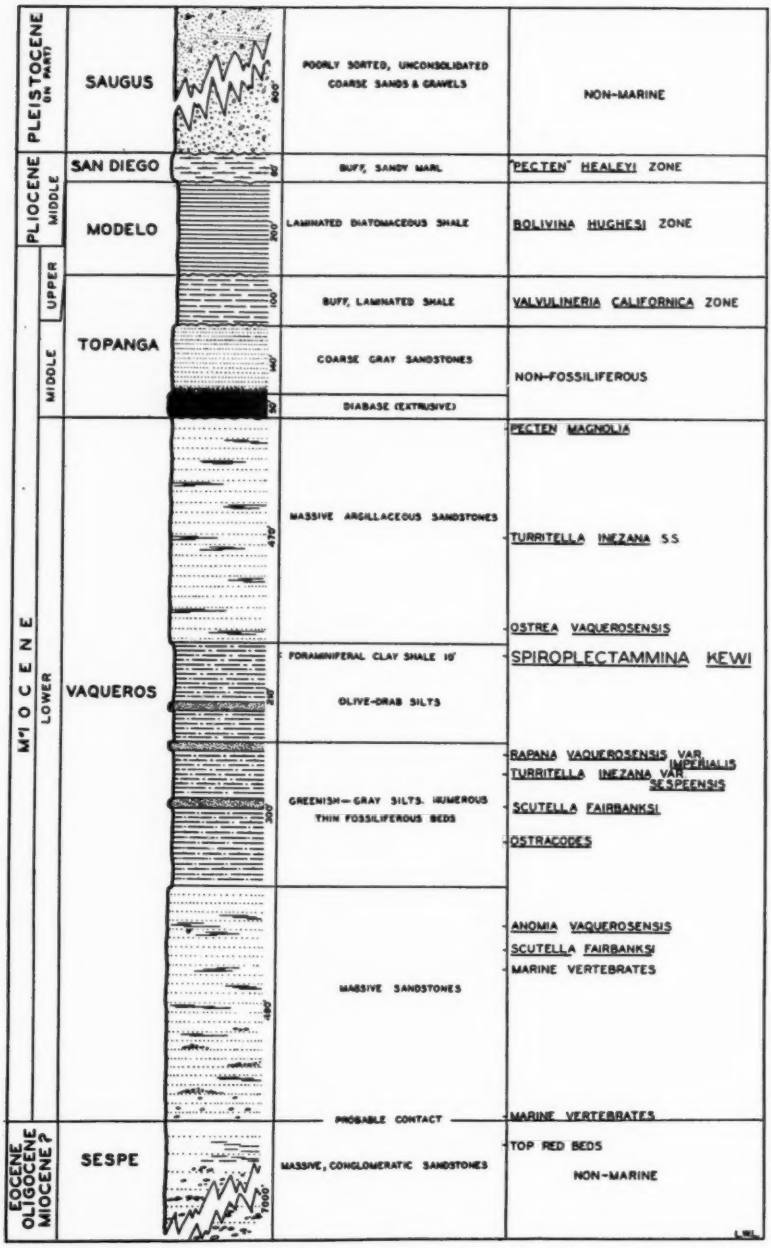


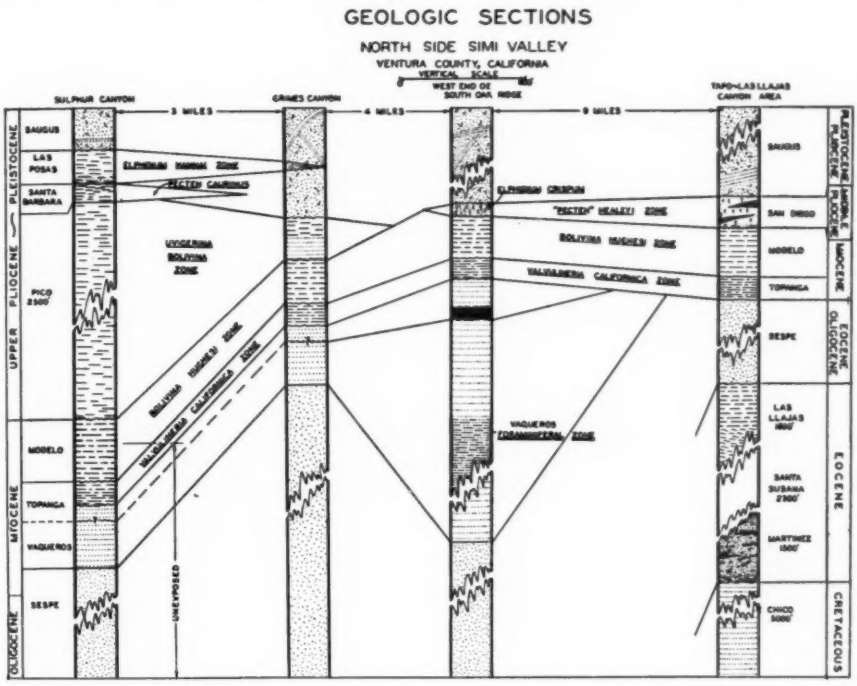
FIG. 2.—A generalized columnar section of South Oak Ridge, Simi Valley, Ventura County, California.

feet), *Turritella inezana* s.s. (250 feet), *Olivella pedroana subpedroana* (250 feet), *Ostrea vaquerosensis* (60 feet), and above *Turritella inezana sespeensis* (200 feet), *Rapana vaquerosensis imperialis* (170 feet), and *Scutella fairbanksi* (250 feet).

The foraminiferal occurrence is estimated to lie approximately 5,000 feet stratigraphically above a zone of upper Eocene vertebrates recorded from the Sespe formation by Stock (1932). This vertebrate fauna includes such forms as triplopine? rhinoceros, amynodont, titanotheres, insectivores, rodents, creodonts.

The Foraminifera are present in great abundance, and are excellently preserved. The sediments contain approximately 5 per cent by volume of calcified foraminiferal tests within the upper part of the zone. The fauna is comparatively small, comprising but 17 genera and 20 species. Great numbers of *Buliminella curta*, *Virgulina bramlettei*, *Spiroplectammina coreyi*, n. sp., *Spiroplectammina kewi*, n. sp., and *Ammobaculites strathearnensis*, n. sp., in association with *Valvulineria casitasensis*, characterize the zone assemblage.

Ostracodes and echinoid spines are common, particularly in the lower part of the zone. Pyritized diatoms and Radiolaria are commonly present. There also occurs in the lower 3 feet, a 3-inch seam containing a dwarfed molluscan fauna, of which the genera *Cardium*, *Nassa*, *Arca* and several gastropod species are most common.



The affinity of the Vaqueros microfauna discussed in this paper to various foraminiferal groups whose stratigraphic position has been noted either above or below the "*Turritella inezana* zone" is summarized as follows:

(1) Nonrelated to: (a) the microfauna of the Gaviota formation (Effinger, 1935), Refugian stage (Schenck and Kleinpell, 1936) upper Eocene-lower Oligocene; (b) the microfauna of the San

Lorenzo formation, Oligocene, as described by Cushman and Hobson (1935); (c) the microfauna from the Vaqueros as described by Barbat and von Estorff (1933).

(2) Related to the microfauna of the lower part of the Rincon shale, Temblor, middle Miocene, as described by Cushman and Laiming (1931). Of the 20 species from the Spring Canyon locality, 8 are present in the lower member of the Los Sauces section.

In conclusion, it may be stated definitely that the Vaqueros foraminiferal assemblage from the Simi Valley localities is more closely allied and related to the microfaunas occurring above the "*Turritella inezana* zone" rather than to those present below as recorded to date.

Acknowledgments.—The junior writer is greatly indebted to Mr. W. H. Corey for his valuable aid in establishing the molluscan zone sequence and determination of the Vaqueros megafossils discussed in this paper. He also wishes to extend his thanks to Mr. Boris Laiming, Mr. L. Forrest, Mr. Wayne Loel, and to the various members of the Geological Staff of the Standard Oil Company of California for their helpful suggestions and criticisms.

SYSTEMATIC DESCRIPTIONS

Family LITUOLIDAE

Genus AMMOBACULITES Cushman, 1910

AMMOBACULITES STRATHEARNENSIS Cushman and LeRoy, n. sp.

Plate 22, figures 1*a*, *b*, 2*a*, *b*

Test longer than broad, strongly compressed, early portion consisting of five or six chambers, coiled, involute, later uncoiled, dorsal wall curved, ventral wall nearly straight; chambers rather indistinct, not inflated, the later ones often less wide toward the apertural end; sutures indistinct, earlier ones nearly radial, later ones oblique; wall very coarsely arenaceous, with brownish cement; aperture terminal, narrowly elliptical, often with a slightly projecting neck. Length 1.30 mm.; breadth 0.80 mm.; thickness 0.20 mm.

Holotype (Cushman Coll., no. 23,685) from Miocene, Vaqueros formation, Spring Canyon, 2,400 feet south and 2,600 feet east of intersection of W. Long. 118° 50′ and N. Lat. 34° 20′, Piru quadrangle, Calif.

This species differs from *A. foliaceus* (H. B. Brady) in the involute early coiled portion with fewer chambers, smaller uncoiled portion with fewer chambers.

Genus CYCLAMMINA H. B. Brady, 1876

CYCLAMMINA cf. INCISA (Stache)

Plate 22, figures 3*a*, *b*

The specimens of this species are all somewhat crushed, as is common in this genus. It is comparatively rare in our material and occurred only in the thin molluscan seam at the base of the zone.

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

SPIROPLECTAMMINA KEWI Cushman and LeRoy, n. sp.

Plate 22, figures 4*a*, *b*

Test elongate, nearly twice as long as broad, tapering from the subacute initial end to the greatest breadth at the apertural end, which is truncate, compressed rhomboid in end view, periphery slightly serrate, subacute; chambers distinct, earliest ones coiled planispirally, very soon replaced by biserial chambers, low and broad, 10 to 12 pairs in the adult, increasing very gradually in size as added, not inflated; sutures distinct, nearly at right angles to the elongate axis, strongly raised above the surface of the chambers, fusing to form a high, rounded, median,

longitudinal ridge; wall arenaceous, with much cement; aperture a low opening at the inner margin of the last-formed chamber. Length 1.65 mm.; breadth 0.80 mm.; thickness 0.30 mm.

Holotype (Cushman Coll., no. 23,690) from Miocene, Vaqueros formation, Spring Canyon, 2,400 feet south and 2,600 feet east of intersection of W. Long. 118° 50′ and N. Lat. 34° 20′, Piru quadrangle, Calif.

Spiroplectammina kewi differs from *S. milletti* (Cushman) in the narrower, more tapering test, less oblique sutures, and the definite median raised ridge. This species is most commonly associated with the dwarfed molluscan fauna in the lower part of the foraminiferal zone. It is named in honor of Dr. W. S. W. Kew, who has contributed greatly to the knowledge of the geology of the Simi Valley and related regions.

SPIROPLECTAMMINA COREYI Cushman and LeRoy, n. sp.

Plate 22, figures 5*a*, *b*

Test elongate, about two and one-half times as long as wide, early portion tapering, adult portion with the sides nearly parallel, thickest in the middle, thence thinning toward the acute periphery which is slightly carinate and serrate; chambers in the earliest stages planispiral, later biserial, seven to nine pairs in the adult, increasing rapidly in size and especially in height toward the apertural end, somewhat inflated; sutures distinct, very slightly depressed, occasionally thickened and raised, earlier ones strongly oblique forming an angle of about 45 degrees with the axis of the test, but later gradually less oblique; wall finely arenaceous, rather smoothly finished; aperture a rather high, arched opening at the inner margin of the last-formed chamber. Length 1.50 mm.; breadth 0.65 mm.; thickness 0.30 mm.

Holotype (Cushman Coll., no. 23,693) from Miocene, Vaqueros formation, Spring Canyon, 2,400 feet south and 2,600 feet east of intersection of W. Long. 118° 50′ and N. Lat. 34° 20′, Piru quadrangle, Calif.

Spiroplectammina coreyi occurs in considerable numbers in the thin molluscan zone at the base of the foraminiferal shale. It differs from *S. articulata* (d'Orbigny), which it much resembles, in the more carinate periphery and more oblique sutures in the early portion. This species is named in honor of Mr. W. H. Corey, who has done much in making this paper possible.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA cf. TRIANGULARIS Cushman

Plate 22, figures 6*a*, *b*

This form is extremely rare in our material. It is close to the form recorded by Cushman and Laiming under this name from the Miocene of Los Sauces Creek.

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1860

TROCHAMMINA PALEA Cushman and LeRoy, n. sp.

Plate 22, figures 7*a–c*

Test strongly compressed, flat and scale-like, dorsal side very slightly convex, ventral side flattened, umbilical region slightly depressed, periphery subacute; chambers numerous, eight or nine in the adult whorl, of rather uniform shape throughout and increasing very gradually in size as added; sutures very slightly depressed, nearly radial on both dorsal and ventral sides; wall rather coarsely arenaceous, surface somewhat roughened; aperture a narrow opening on the ventral side at the margin of the last-formed chamber. Length 0.70 to 0.80 mm.; breadth 0.50 to 0.60 mm.; thickness 0.12 to 0.15 mm.

Holotype (Cushman Coll., no. 23,696) from Miocene, Vaqueros formation, Spring Canyon, 2,400 feet south and 2,600 feet east of intersection of W. Long.

118° 50′ and N. Lat. 34° 20′, Piru quadrangle, California.

This species is rather common in the lower part of the zone. It differs from *T. parva* Cushman and Laiming in the larger number of chambers in the whorl, and the flatter, more compressed test, especially on the ventral side.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS NIKOBARENSIS (Schwager) var. WARMANI Barbat and von Estorff
Plate 22, figures 11*a*, *b*

Robulus nikobarensis (Schwager) var. *warmani* BARBAT and VON ESTORFF, *1933*, Jour. Paleontology, vol. 7, p. 169, pl. 23, figs. 12*a*, *b*.

Our specimen resembles the above variety in general characters. It is variable in the amount of involution and in the development of the keel. We have tried to select a specimen that would show an average of our material. It occurs more frequently in the upper part of the zone, and is commonly associated with *Valvulineria casitasensis* Cushman and Laiming.

ROBULUS MAYI Cushman and Parker
Plate 22, figures 10*a*, *b*

Robulus mayi CUSHMAN and PARKER, *1931*, Cushman Lab. Foram. Research, Contr., vol. 7, p. 2, pl. 1, figs. 3–5.

This species is very rare in our material, but, although showing some variation, seems to be fairly typical.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA DUBIA Neugeboren
Plate 22, figure 15

This species is extremely rare, but is similar to other Miocene specimens recorded from California.

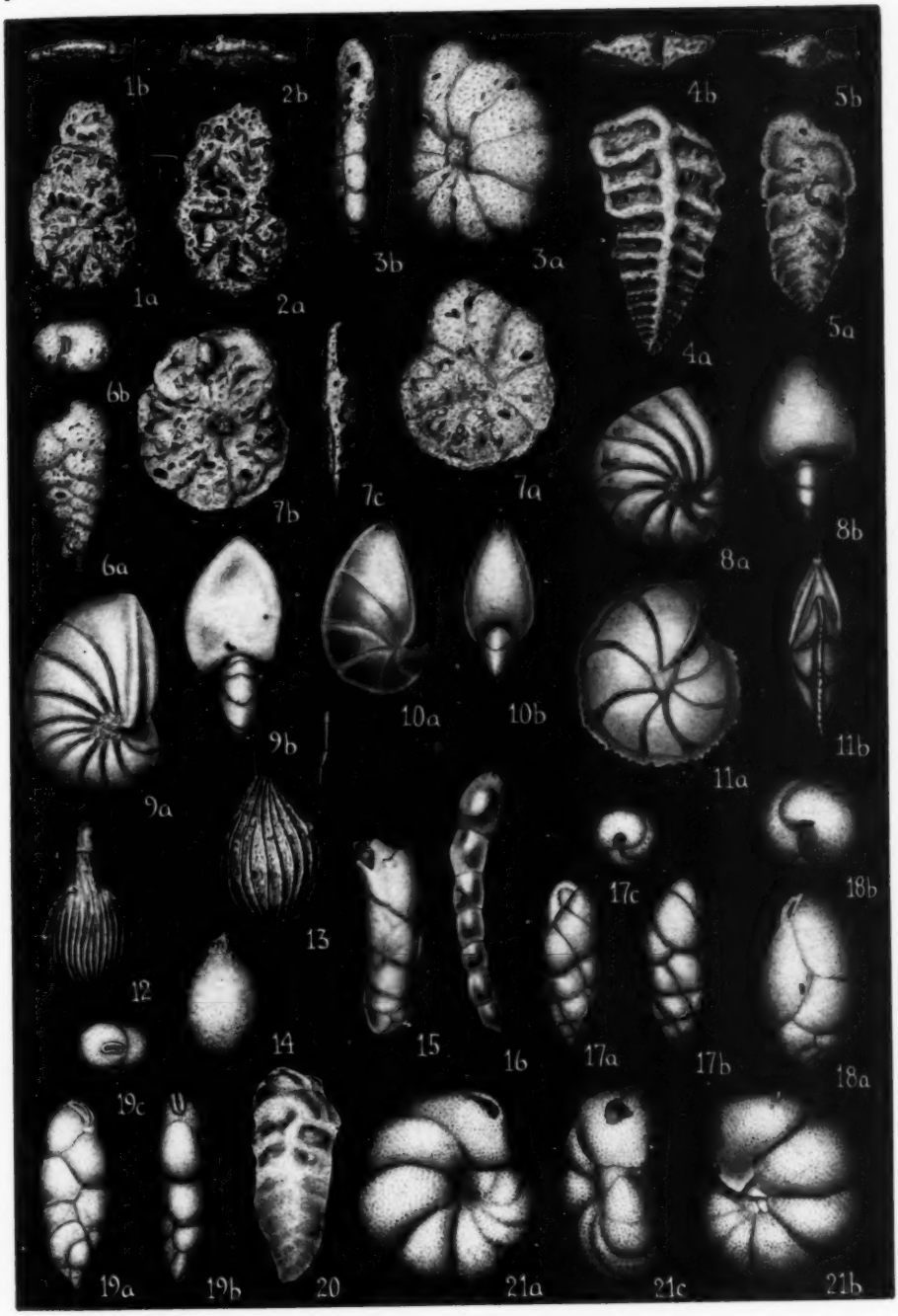
Genus DENTALINA d'Orbigny, 1826

DENTALINA cf. PAUPERATA d'Orbigny
Plate 22, figure 16

Specimens are very rare and most of them very fragmentary.

EXPLANATION OF PLATE 22

FIGS. *1*, *2*—*Ammobaculites strathearnensis* Cushman and LeRoy, n. sp. ×22. *1*, Holotype. *2*, Paratype. *a*, *a*, Side views; *b*, *b*, apertural views. (p. 122)
3—*Cyclammina* cf. *incisa* (Stache). ×22. *a*, Side view; *b*, peripheral view. (p. 122)
4—*Spiroplectammina kewi* Cushman and LeRoy, n. sp. ×22. *a*, Front view; *b*, apertural view. (p. 122)
5—*Spiroplectammina coreyi* Cushman and LeRoy, n. sp. ×22. *a*, Front view; *b*, apertural view. (p. 123)
6—*Gaudryina* cf. *triangularis* Cushman. ×40. *a*, Front view; *b*, apertural view. (p. 123)
7—*Trochammina palea* Cushman and LeRoy, n. sp. ×40. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. (p. 123)
8—*Nonion incisum* (Cushman). ×40. *a*, Side view; *b*, apertural view. (p. 125)
9—*Nonion incisum* (Cushman) var. ×45. *a*, Side view; *b*, apertural view. (p. 125)
10—*Robulus mayi* Cushman and Parker. ×45. *a*, Side view; *b*, apertural view. (p. 124)
11—*Robulus nikobarensis* (Schwager) var. *warmani* Barbat and von Estorff. ×25. *a*, Side view; *b*, apertural view. (p. 124)
12—*Lagena substriata* Williamson, ×60. (p. 125)
13—*Lagena sulcata* Walker and Jacob, ×60. (p. 125)
14—*Lagena clavata* (d'Orbigny) (?), ×60. (p. 125)
15—*Marginulina dubia* Neugeboren, ×40. (p. 124)
16—*Dentalina* cf. *pauperata* d'Orbigny, ×32. (p. 124)
17—*Buliminella curta* Cushman, ×60. *a*, Front view; *b*, rear view; *c*, apertural view. (p. 125)
18—*Bulimina ovula* d'Orbigny, ×40. *a*, Front view; *b*, apertural view. (p. 125)
19—*Virgulina bramlettei* Galloway and Morrey, ×60. *a*, Front view; *b*, side view; *c*, apertural view. (p. 125)
20—*Bolivina* cf. *obliqua* Barbat and Johnson, ×65. (p. 125)
21—*Valvulineria casitasensis* Cushman and Laiming, ×32. *a*, Dorsal view; *b*, ventral view; *c*, peripheral view. (p. 125)



Cushman and LeRoy, Miocene Foraminifera

UNIV. OF MICH.

Genus LAGENA Walker and Jacob, 1798

LAGENA SUBSTRIATA Williamson
Plate 22, figure 12

The species of *Lagena* are very rare in this material, but are figured here to make the series complete.

LAGENA SULCATA Walker and Jacob
Plate 22, figure 13

The specimen is broken at the apertural end.

LAGENA CLAVATA (d'Orbigny) ?
Plate 22, figure 14

The figured specimen is incomplete. The surface is either smooth or slightly hispid, perhaps due partly to the adhering material.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION INCISUM (Cushman)
Plate 22, figures 8*a*, *b*

Specimens which seem referable to this species occur in considerable numbers throughout the zone. They are more than usually variable.

NONION INCISUM (Cushman) var.
Plate 22, figures 9*a*, *b*

The figured specimen shows a variety which tends somewhat toward *N. costiferum* (Cushman) with the apertural face almost angled toward the base. Some of the specimens seem to tend toward *Nonionella*, but more material is needed before a description of this form is warranted.

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

BULIMINELLA CURTA Cushman
Plate 22, figures 17*a–c*

This is one of the most abundant species in our material. There are specimens much like the holotype which did not show the fully adult characters and many others showing the fully developed test.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA BRAMLETTEI Galloway and Morrey
Plate 22, figures 19*a–c*

Next to the above species, this is probably the most common species in this material. It shows some variation in the megalospheric and microspheric forms.

Genus BULIMINA d'Orbigny, 1826

BULIMINA OVULA d'Orbigny
Plate 22, figures 18*a*, *b*

Our figure shows a specimen which does not have the chambers reaching as far toward the base as some others, but is probably an average one for this material. The types of this species are from off South America, and it has previously been recorded from the Miocene of California. Some of the megalospheric specimens approach *Globobulimina*. The species is rather common throughout the zone, but is best preserved in the upper portion.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA cf. OBLIQUA Barbat and Johnson
Plate 22, figure 20

The species of this form are fairly common but not well preserved, more common in the lower part of the zone. Some of the specimens are elongate, and others shorter and stouter, resembling the form figured by Barbat and Johnson (1934).

Family ROTALIIDAE

Genus VALVULINERIA Cushman, 1926

VALVULINERIA CASITASENSIS Cushman and Laiming
Plate 22, figures 21*a–c*

Valvulineria casitasensis CUSHMAN and LAIMING, *1931*, Jour. Paleontology, vol. 5, p. 113, pl. 13, figs. 1*a–c*.

Our figure shows a very typical specimen of this species. It is usually well preserved and most common in the upper portion of the zone.

Family GLOBIGERINIDAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA sp.

There are a number of specimens of a small form of *Globigerina*, but owing to the difficulties at the present time in dealing with members of this genus no name has been assigned to this form.

REFERENCES

BARBAT, WILLIAM F., and JOHNSON, FLOYD L., *1934*, Stratigraphy and Foraminifera of the Reef Ridge shale, upper Miocene, California: *Jour. Paleontology*, vol. 8, no. 1, pp. 3–17, pl. 19.

BARBAT, WILLIAM F., and VON ESTORFF, FRITZ E., *1933*, Lower Miocene Foraminifera from the southern San Joaquin Valley, California: *Jour. Paleontology*, vol. 7, no. 2, pp. 164–174.

CUSHMAN, J. A., and HOBSON, H. D., *1935*, A foraminiferal faunule from the type San Lorenzo formation, Santa Cruz County, Calif.: *Cushman Lab. Foram. Research, Contr.*, vol. 11, no. 158.

CUSHMAN, J. A., and LAIMING, B., *1931*, Miocene Foraminifera from Los Sauces Creek, Ventura County, Calif.: *Jour. Paleontology*, vol. 5, no. 2, pp. 79–120.

EFFINGER, WILLIAM L. E., *1936*, Gaviota formation of Santa Barbara County, Calif.: *Geol. Soc. America, Proc. for 1935*, pp. 351, 352.

KEW, W. S. W., *1919*, Structure and oil resources of the Simi Valley, southern California: *U. S. Geol. Survey, Bull.* 691-M.

LOEL, WAYNE, and COREY, W. H., *1932*, The Vaqueros formation, lower Miocene, of California; I, Paleontology: *California Univ., Dept. Geol. Sci., Bull.*, vol. 22, no. 3, pp. 31–410.

SCHENCK, H. G., and KLEINPELL, R. M., *1936*, Refugian stage of Pacific Coast Tertiary: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 20, no. 2, pp. 215–225.

STOCK, CHESTER, *1930*, Oreodonts from the Sespe deposits of South Mountain, Ventura County, California: *Carnegie Inst. Washington, Pub.* 404, pp. 27–41.

———, *1932*, Eocene land mammals on the Pacific Coast: *Nat. Acad. Sci., Proc.*, vol. 18, no. 7, pp. 518–523.

———, *1932a*, An upper Oligocene mammalian fauna from southern California: *Nat. Acad. Sci., Proc.*, vol. 18, no. 8, pp. 550–554.

J. A. CUSHMAN, SHARON, MASSACHUSETTS. L. W. LEROY, c/o NEDERLANDSCHE PACIFIC PETROLEUM MAATSCHAPPIJ, BATAVIA CENTRUM, JAVA, NETHERLANDS EAST INDIES. MANUSCRIPT RECEIVED BY THE EDITOR, APRIL, 1937.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 127–148, PLS. 23, 24, TEXT FIGS. 1–20, MARCH, 1938.

MIOCENE AND PLIOCENE OSTRACODA OF THE GENUS *CYTHERIDEA* FROM FLORIDA

MORTON B. STEPHENSON

ABSTRACT

Fourteen species of the ostracode genus *Cytheridea*, twelve new, are described and assigned to the subgenera *Haplocytheridea* and *Leptocytheridea*. Two new genera, *Anomocytheridea* and *Perissocytheridea*, are proposed, with four species assigned to the former and two to the latter. These microfossils come from the Florida Tertiary, and include the Caloosahatchee marl in the Pliocene, and in the Miocene, the *Arca* zone of the Choctawhatchee, the Shoal River, Oak Grove, and Chipola formations. Fossils are likewise described from the type locality of the *Potamides matsoni* zone in Rapides Parish, Louisiana.

Correlation of the Miocene and Pliocene sediments of Florida by means of microfossils has seen marked advances through the series of excellent studies published in the bulletins of the Florida State Geological Survey. Of these, the work of Cushman (1930) on the Foraminifera of the Choctawhatchee formation was the first to appear. A later contribution by Cushman and Ponton (1932) enlarged and extended this study to include nearly all of the Miocene outcropping in the State. Cole (1931) has treated the Pliocene and Pleistocene Foraminifera together in another report. Very little has been done, however, on the Ostracoda of the Florida section. The earlier work of Ulrich and Bassler (1904) on the Maryland Miocene contained a number of species which are recognizable in the Florida formations. A recent study by Howe, and graduate students of Louisiana State University (1935), deals with the Ostracoda of the *Arca* zone of the Choctawhatchee formation.

The present study is an attempt to aid in the correlation of the Miocene and Pliocene sediments of Florida through the use of the ostracode genus *Cytheridea*. This genus is very abundantly represented in the Florida section, and the species are on the whole of short range and easy of identification. I have chosen the localities used in this report from the stations of the Florida State Geological Survey which contain the most abundant and representative ostracode faunas. The Pliocene species here reported are from a single locality in the Caloosahatchee marl, at which the Ostracoda are common and well preserved. The sedimentary sequence of Miocene formations here used is identical with that adopted by the Florida State Geological Survey. For the present study, it seems necessary only to give the stratigraphic sequence of Miocene sediments from which species are described in this report. These formations, listed in order from youngest to oldest, are the *Arca* zone of the Choctawhatchee (upper middle Miocene), the Shoal River and Oak Grove (middle Miocene), and the Chipola (lower Miocene). For a detailed discussion of the Miocene section here included, the reader is referred to Cooke and Mossom (1929).

A single station from Louisiana, Loc. 8, the type locality of the *Potamides matsoni* zone in Rapides Parish, is included in the present study. I feel that, as the fauna of this zone has not been identified from outcrop material in Florida, and as there is some confusion in the identification of the zone in the subsurface, it may be well to define some of the diagnostic microfossils more closely and consider them in their relationship to those of the Florida section. The present work, while adding to the fauna previously described

by me from the zone (Stephenson, 1935), has not definitely placed it in the stratigraphic sequence of Florida. Howe and McGuirt (1936) have stated that

> The full time range of neither *Rangia johnsoni* nor the *Potamides matsoni* zone ostracodes has been established . . . it would appear that both may occur in brackish water equivalents of the *Arca* zone of the Choctawhatchee, and that the presence of either is not proof positive of upper Miocene or lower Pliocene.

The latter statement was based on a study of cores from the Humble's Cockerell-Moran No. 23 well, Lake Washington dome, Plaquemines Parish, La., at depths of 4,492–4,497 and 4,497–4,502 feet. I have examined the faunas in question and, while *Perissocytheridea matsoni* and *Microcythere moresiana* are present, I was unable to identify *Anomocytheridea locketti*, the one species of the three which is diagnostic for the zone. This material may apparently be, then, either *Rangia johnsoni* or *Potamides matsoni* zone in age, and does not definitely place the latter zone stratigraphically. It seems probable to me, however, that the conclusion reached is correct, and that the *Potamides matsoni* zone is likely to be correlated with the *Arca* zone of the Choctawhatchee formation. The strong similarity between *Anomocytheridea locketti* and *A. floridana* suggests that the former species is the brackish water equivalent of the latter.

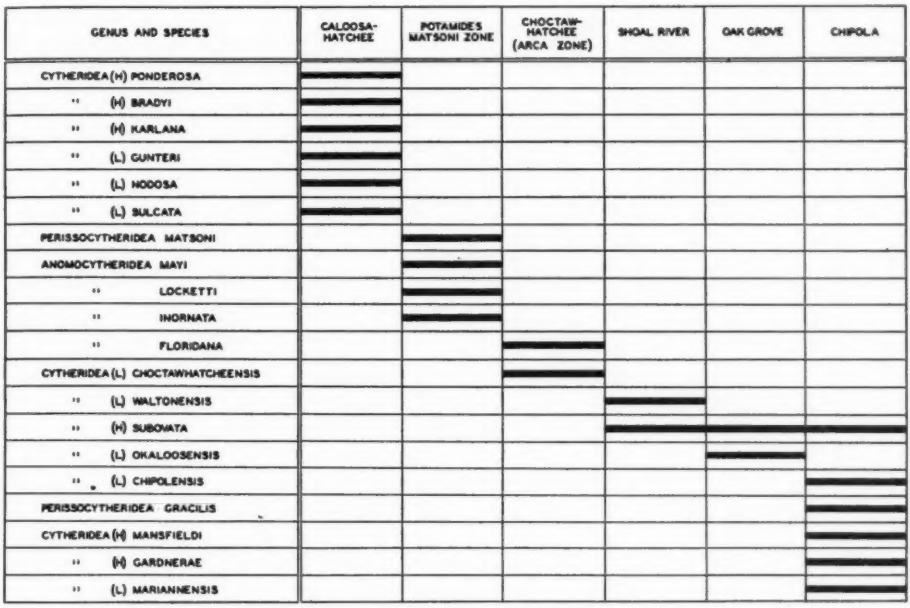
The faunule included within the genus *Cytheridea* in the Miocene and Pliocene sediments of Florida represents a somewhat changing aspect from that encountered lower in the Gulf Coast section. The subgenus *Clithrocytheridea*, which is found so commonly in the Eocene and more rarely in the Oligocene, has not been identified in my present study of the Florida Miocene and Pliocene. The subgenus *Haplocytheridea* continues through the Upper Tertiary, although somewhat less abundantly than lower in the section. The fragile species of the subgenus *Leptocytheridea* are more common in most of the Miocene formations of Florida than is the case lower in the section, and at times form a substantial portion of the ostracode fauna. The two new genera, *Anomocytheridea* and *Perissocytheridea*, which are here segregated as distinct from the genus *Cytheridea*, include several species of value as stratigraphic indices in the Gulf Coast section. The short range of species here described is indicated on the included range chart. It will be noted that only one species, *C.* (*H.*) *subovata* Ulrich and Bassler, has a range of more than one formation in the Florida section.

Occurring with the genus *Cytheridea* in the Florida Miocene, at times in large numbers, are specimens of species of the genus *Cytherideis*. These species of *Cytherideis* are, upon superficial examination, very similar to *Cytheridea*. They are in general, however, somewhat more elongate in side view, and the hinge structure is less complex. The hinge line of *Cytherideis ashermani* Ulrich and Bassler is included in this report (pl. 24, figs. 15, 16) as being characteristic for the genus, and a ready means of differentiating it from the genus *Cytheridea*. The taxodont type of terminal dentitions found in *Cytheridea*, with the dental areas divided into a number of distinct cusps, is lacking in *Cytherideis*. The marginal area of the right valve bears a carinate ridge, extending around the anterior, ventral, and posterior margins, and becoming most pronounced at the ends of the hinge line, where the ridge is abruptly truncated into a slender connecting furrow. The hinge of the left valve is equipped with elongate terminal sockets which are not crenulated, and which are connected by the dorsal margin.

I am deeply indebted to Dr. Henry V. Howe, Director of the School of Geology, Louisiana State University, for making available to me numerous samples from the Florida Miocene and Pliocene, without which this study would have been impossible. Doctor Howe has likewise furnished numerous suggestions and criticisms while the study was in progress.

My thanks are extended to Dr. C. I. Alexander, Magnolia Petroleum Company, Lake Charles, La., who presented to me topotype specimens of *Cytheridea insolita* Alexander and Alexander.

The type specimens upon which this report is based have been deposited in the Henry V. Howe collection, Louisiana State University, Baton Rouge, La. The localities from which specimens were obtained are described at the end of the paper.



Range chart for Miocene and Pliocene Ostracoda from Florida.

SYSTEMATIC DESCRIPTIONS

Family CYTHERIDAE Baird, 1850

Genus CYTHERIDEA Bosquet, 1852

Subgenus HAPLOCYTHERIDEA Stephenson, 1936

CYTHERIDEA (HAPLOCYTHERIDEA) BRADYI Stephenson, n. sp.

Plate 23, figure 22; Plate 24, figures 5, 6; Text figure 10

Carapace elongate, in side view subpyriform, highest at or slightly anterior to the middle, greatest inflation near the posterior end. Left valve smaller, and bearing a carinate flange on anterior and posterior ends, which fits inside the larger right valve. Dorsal margin gently arched with weak cardinal angles; ventral margin convex or slightly sinuated. Anterior end broadly rounded; posterior end more narrowly rounded, bluntly truncated in the left valve. Surface covered with moderately deep, fairly numerous, rather small pits which become obscure toward the periphery. Area between pits smooth, presenting a very faintly granular appearance under higher magnifications. Hinge line exhibits a reversal of the structure normal for the genus; in the right valve with elongate, faintly notched, well-incised terminal sockets, connected by a faintly de-

pressed, crenulate groove. The terminal sockets are outlined dorsally by lobes of the dorsal margin, which also extends as a faint bar between them and above the connecting groove. In the left valve, hinge with elongate, high, faintly notched terminal dentitions, the anterior much more prominent than the posterior. Between the dental areas and slightly lower than them is a faintly notched bar, set off from the dorsal margin by a weakly depressed area. Marginal areas of moderate width on the anterior, narrow on the posterior, carrying about 20 straight, simple radial pore canals on the anterior. Line of concrescence very slightly inside the inner margin on the anterior end.

Length (right valve) 0.70 mm.; height 0.37 mm.

Remarks.—*C.* (*H.*) *bradyi* is an interesting species in that it presents the rather unusual phenomenon of reversal in valve size and hinge structure. In all the specimens in my collections, the left valve is slightly smaller than the right and fits inside it. The hinge line, with terminal dentitions and connecting bar, normally found in the right valve in this genus, is located in the left valve in this species. The species, which I have noted only at Loc. 1 in the Caloosahatchee marl, from which it is described, is very rare at the type locality. All of the specimens studied presented the abnormal conditions above noted, but it is probable that a larger number of specimens would show some with normal relationships in valve size and hinge structure.

The anomaly of reversal of valve size and hinge structure has been noted by Brady (1880). In a generic description of *Cytheridea* in the *Challenger Report*, Brady noted the following:

> Valves unequal, the left mostly larger than the right. . . Hinges composed of two crenulated crests on the left (occasionally the right) valve, which articulate with corresponding depressions of the opposite valve.

A similar reversal has been more recently noted by Alexander and Alexander (1933). A species of *Cytheridea*, *C. insolita*, from the Taylor formation of the Upper Cretaceous of Texas, wasdescribed in this paper. Where the species occurred

---

EXPLANATION OF TEXT FIGURES 1–20

All figures ×20, unless otherwise indicated

FIGS. *1*, *16*—*Cytheridea* (*Leptocytheridea*) *gunteri* Stephenson, n. sp. *1*, Dorsal view of left and right valves, showing articulation of hinge, ×30. *16*, Outline of lateral view of left valve. (p. 137)

2, *6*, *19*, *20*—*Anomocytheridea floridana* (Howe and Hough). *2*, Dorsal view of left and right valves, showing articulation of hinge. *6*, Muscle scar pattern of a left valve, ×100. *19*, *20*, Anterior and posterior marginal areas of a right valve, showing radial pore canals, ×40. (p. 142)

3—*Cytheridea* (*Haplocytheridea*) *subovata* Ulrich and Bassler. Dorsal view. (p. 134)

4, *7*, *11*—*Perissocytheridea matsoni* (Stephenson). *4*, Dorsal view of left and right valves of a male, showing articulation of hinge, ×50. *7*, Interior of left valve of a male, ×50. *11*, Lateral view of left valve of a female, ×50. (p. 145)

5—*Cytheridea* (*Leptocytheridea*) *chipolensis* Stephenson, n. sp. Outline of lateral view of left valve. (p. 136)

8—*Cytheridea* (*Leptocytheridea*) *okaloosensis* Stephenson, n. sp. Outline of lateral view of left valve. (p. 139)

9—*Anomocytheridea mayi* Stephenson, n. sp. Outline of lateral view of left valve. (p. 144)

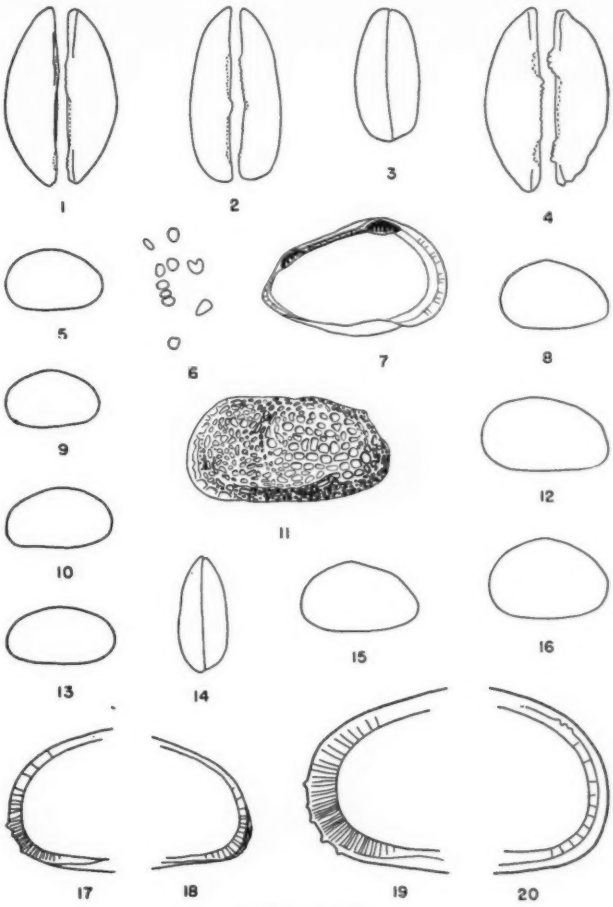
10—*Cytheridea* (*Haplocytheridea*) *bradyi* Stephenson, n. sp. Outline of lateral view of left valve. (p. 129)

12, *17*, *18*—*Cytheridea* (*Leptocytheridea*) *choctawhatcheensis* Howe and Stephenson. *12*, Outline of lateral view of left valve. *17*, *18*, Anterior and posterior marginal areas of a right valve, ×40. (p. 137)

13—*Cytheridea* (*Haplocytheridea*) *mansfieldi* Stephenson, n. sp. Outline of lateral view of right valve. (p. 133)

14—*Anomocytheridea inornata* Stephenson, n. sp. Dorsal view. (p. 142)

15—*Cytheridea* (*Leptocytheridea*) *waltonensis* Stephenson, n. sp. Outline of lateral view of left valve. (p. 140)



FIGURES 1–20

abundantly, it was noted that about 75 per cent of the specimens were found to have the right valve larger than the left. Through the kindness of Dr. C. I. Alexander, I have been able to study both normal and abnormal specimens of this species, and have found the abnormal type to be very similar to my specimens of the new species *C.* (*H.*) *bradyi*.

C. (*H.*) *bradyi* bears some resemblance to *C.* (*H.*) *hadleyi* Stephenson (1937, pp. 150, 151, pl. 26, fig. 16), from the basal Moody's Branch marl, Jackson Eocene, of Mississippi. The secondary granular pitting on the exterior of the carapace of the new species is much less pronounced and scarcely noticeable, and the carapace is shorter in side view, with a higher posterior cardinal angle and more broadly rounded anterior cardinal angle. The new species is readily distinguished from *C.* (*L.*) *mariannensis*, n. sp., from the Chipola, on the basis of its stronger hinge structure, which is of the *Haplocytheridea* type, and its much heavier carapace wall. *C.* (*H.*) *bradyi* exhibits sexual dimorphism, the female being higher and more inflated posteriorly than the male.

The species is named in honor of G. S.

Brady, who early noted the anomalous condition exhibited by this species.

Occurrence.—As I have stated above, this species has been observed by me only at Loc. 1 in the Caloosahatchee marl, Pliocene of Florida, where it is rare.

Types.—Holotype (right valve), H. V. Howe coll., no. 1539; paratype, no. 1540, from Loc. 1.

CYTHERIDEA (HAPLOCYTHERIDEA) GARDNERAE Stephenson, n. sp.
Plate 23, figure 5

Carapace in side view elongate, subpyriform, highest slightly anterior to the middle. Dorsal margin gently arched, ventral margin slightly convex, often somewhat sinuated. Anterior end well rounded, posterior end lower and more narrowly rounded. Surface covered with fine, closely spaced pits, the pitting becoming obscure in the vicinity of the periphery. Hinge in the right valve composed of elongate taxodont dental areas, which are most prominent at their outer extremities, and which merge with a somewhat lower, faintly crenulate connecting bar. Hinge of the left valve is composed of narrow, notched sockets, corresponding to the terminal dentitions of the right valve. Between the sockets and continuous with them is a slender groove, bounded dorsally by the low dorsal margin, and ventrally by a very narrow bar which becomes inconspicuous toward the posterior. Marginal areas of moderate width, carrying about 15 fairly straight, simple radial pore canals on the anterior, with a fewer number on the posterior.

Length (right valve) 0.70 mm.; height 0.37 mm.

Named in honor of Julia Gardner, for her work on the Molluscan fauna of the Alum Bluff group of Florida.

Occurrence.—*C.* (*H.*) *gardnerae* has been observed by me only from Loc. 7 in the Chipola Miocene, at which station it is exceedingly rare. Figured specimens were collected at this locality.

Types.—Holotype (right valve), H. V. Howe coll., no. 1541; paratype, no. 1542.

CYTHERIDEA (HAPLOCYTHERIDEA) KARLANA Stephenson, n. sp.
Plate 23, figure 3

Carapace tumid; in side view subovate, highest at about the middle. Left valve larger than the right, and overlapping it around the entire periphery, with the greatest overlap along the ventral margin. Dorsal margin gently arched, with weak cardinal angles; ventral margin convex, somewhat sinuated in the right valve. Anterior end broadly and evenly rounded; posterior end bluntly and steeply truncated to the rounded postero-ventral angle in the right valve, broadly and evenly rounded in the left valve. Postero-ventral angle of the right valve usually showing occasional small, weakly developed pits. Hinge in the right valve composed of a long, anterior dental area at about the mid-point of the shell length, notched to form about 12 cusps, and a shorter similar, posterior dental area of about six cusps. A low, narrow line of crenulations between and continuous with the dentitions is separated from the dorsal margin by a broad, well-depressed area. Hinge in the left valve consists of elongate, notched, terminal sockets, which narrow to form a faintly incised, crenulate groove continuous between them. A very faint bar above the groove extends in lobes around the sockets, and is separated in the central portion of the hinge from the dorsal margin by a shallow depressed area. Marginal areas of moderate width, with the line of concrescence coinciding with the inner margin throughout. About 30 straight, simple radial pore canals are visible on the anterior, much more closely spaced on the ventral half.

Length 0.94 mm.; height 0.55 mm.; width 0.50 mm.

Remarks.—*C.* (*H.*) *karlana* is much smaller, shorter, more ovate, with a thinner carapace wall than *C.* (*H.*) *ponderosa*, n. sp., with which it occurs at the type locality. It is likewise shorter and more broadly ovate, with weaker

cardinal angles than the Shoal River species *C.* (*H.*) *subovata* Ulrich and Bassler. Its outline in side view, together with hinge structure, readily distinguish it from *Anomocytheridea floridana* (Howe and Hough).

Named in honor of the late Karl E. Young, who collected the type locality.

Occurrence.—This species is confined in my collections to the Caloosahatchee marl, Pliocene, at Loc. 1, from which station figured specimens were obtained.

Types.—Holotype (complete specimen), H. V. Howe coll., no. 1565; paratypes, nos. 1566, 1567.

CYTHERIDEA (HAPLOCYTHERIDEA) MANSFIELDI Stephenson, n. sp.

Plate 23, figure 14; Text figure 13

Carapace tumid, in side view elongate, subovate. Dorsal margin weakly arched, subparallel to the ventral margin, which is slightly convex. Anterior end well rounded; posterior end slightly lower, sloping in an even curve to the rounded postero-ventral angle. Surface smooth, with small, slightly depressed, fairly numerous, faintly visible pits where normal pore canals reach the surface. Hinge in the right valve with narrow, faintly notched dental areas, between which is a slightly lower bar. In the left valve, hinge with elongate, incised, notched terminal sockets, which are continuous with a slender connecting furrow. The dorsal margin extends prominently above the sockets, and as a low bar above the furrow between them. Marginal areas of moderate width on the anterior, narrow on the posterior. About 30 fairly straight radial pore canals are visible on the anterior. Line of concrescence coincides with the inner margin except on the anterior, where it is slightly inside it.

Length (right valve) 0.72 mm.; height 0.36 mm.

Named in honor of W. C. Mansfield, United States Geological Survey, for his work on the Mollusca of the Florida Miocene.

Occurrence.—I have observed *C.* (*H.*) *mansfieldi* occurring in the Chipola only, where it is very rare.

Types.—Holotype (left valve), H. V. Howe coll., no. 1543; paratype, no. 1544. Both specimens were collected at Loc. 7.

CYTHERIDEA (HAPLOCYTHERIDEA) PONDEROSA Stephenson, n. sp.

Plate 23, figure 20; Plate 24, figures 1, 2

Carapace large, tumid, very heavy; in side view subovate, with the greatest height at about the middle. Dorsal margin well arched, flattened along the hinge line, with weak cardinal angles. Ventral margin somewhat convex, more strongly so in the larger left valve. Anterior end well rounded, but more narrowly so than the posterior end. Anterior end in the right valve bears a variable number of very short, blunt, fine, inconspicuous spines on some specimens. Posterior end in the right valve blunt and descending steeply from the fairly high posterior cardinal angle to the rounded postero-ventral angle; posterior end in the left valve broadly and evenly rounded, with a maximum length in this valve at about half its height. Surface smooth, showing a very fine, granular pitting under higher magnifications. Fairly numerous, moderate-sized pits on the entire exterior of the carapace mark the position of normal pore canals, the pits at times showing a knob-like calcareous plug on the tumid portion of the carapace, which is flush or at times raised slightly above the general surface of the shell wall. Hinge structure very strong (pl. 24, figs. 1, 2); in the right valve with a long, heavy, deeply notched anterior dental area of about 10 cusps, and a less prominent posterior dental area of about eight smaller cusps. Between the dentitions and continuous with them is a somewhat lower, strongly notched bar. In the left valve, hinge with a very long, well-incised, deeply notched anterior socket, and a much shorter, notched posterior socket, narrowing to a more slender, shallow, notched connecting groove between them. The dorsal margin strongly over-

hangs the sockets, and is faintly visible above the groove. Radial pore canals simple, about 35 in number on the anterior. Muscle scars six in number, four of which are in a vertical row, with two more anterior to them.

Length (right valve) 1.14 mm.; height 0.75 mm.

Remarks.—The large size and heavy shell structure of this species serve to distinguish it from all other members of the genus which I have encountered in the Gulf Coast Tertiary. It is much larger, heavier, and higher in side view than *C.* (*H.*) *karlana* with which it occurs, and the same features readily separate it from *C.* (*H.*) *subovata* in the Shoal River formation.

Occurrence.—I have observed *C.* (*H.*) *ponderosa* at a single station, Loc. 1, in the Caloosahatchee marl, Pliocene.

Types.—Holotype (right valve), H. V. Howe coll., no. 1545; paratype, no. 1546. Both specimens are from Loc. 1.

CYTHERIDEA (HAPLOCYTHERIDEA) SUBOVATA Ulrich and Bassler

Plate 23, figure 23; Plate 24, figures 9, 10; Text figure 3

Cytheridea subovata ULRICH and BASSLER, *1904*, Maryland Geol. Survey, Miocene Rept., pp. 124, 125, pl. 37, figs. 1–8.

Carapace tumid, in side view subovate, highest at or slightly anterior to the middle. Dorsal margin gently arched, passing in an even curve into the broadly

---

EXPLANATION OF PLATE 23

All figures ×40, unless otherwise indicated

FIGS. *1, 4, 7, 8—Anomocytheridea locketti* (Stephenson). *1*, Lateral view of right valve of a male. *4*, Lateral view of left valve of a male. *7*, Interior of right valve of a male. *8*, Lateral view of left valve of a female (syntype no. 1408). (p. 143)

2—Cytheridea (*Leptocytheridea*) *sulcata* Stephenson, n. sp. Lateral view of right valve. (p. 139)

3—Cytheridea (*Haplocytheridea*) *karlana* Stephenson, n. sp. Right valve view. (p. 132)

5—Cytheridea (*Haplocytheridea*) *gardnerae* Stephenson, n. sp. Lateral view of right valve. (p. 132)

6—Cytheridea (*Leptocytheridea*) *gunteri* Stephenson, n. sp. Lateral view of right valve. (p. 137)

9—Cytheridea (*Leptocytheridea*) *choctawhatcheensis* Howe and Stephenson. Lateral view of right valve. (p. 137)

10—Perissocytheridea matsoni (Stephenson). Lateral view of left valve of a male, ×50. (p. 145)

11—Perissocytheridea gracilis Stephenson, n. sp. Lateral view of right valve, ×50. (p. 146)

12—Cytheridea (*Leptocytheridea*) *mariannensis* Stephenson, n. sp. Lateral view of left valve. (p. 138)

13—Cytheridea (*Leptocytheridea*) *waltonensis* Stephenson, n. sp. Lateral view of right valve. (p. 140)

14—Cytheridea (*Haplocytheridea*) *mansfieldi* Stephenson, n. sp. Lateral view of left valve. (p. 133)

15—Anomocytheridea floridana (Howe and Hough). Lateral view of right valve. (p. 142)

16—Cytheridea (*Leptocytheridea*) *okaloosensis* Stephenson, n. sp. Lateral view of right valve. (p. 139)

17, 19—Anomocytheridea inornata Stephenson, n. sp. *17*, Lateral view of right valve of a male. *19*, Lateral view of right valve of a female. (p. 142)

18—Cytheridea (*Leptocytheridea*) *chipolensis* Stephenson, n. sp. Lateral view of right valve. (p. 136)

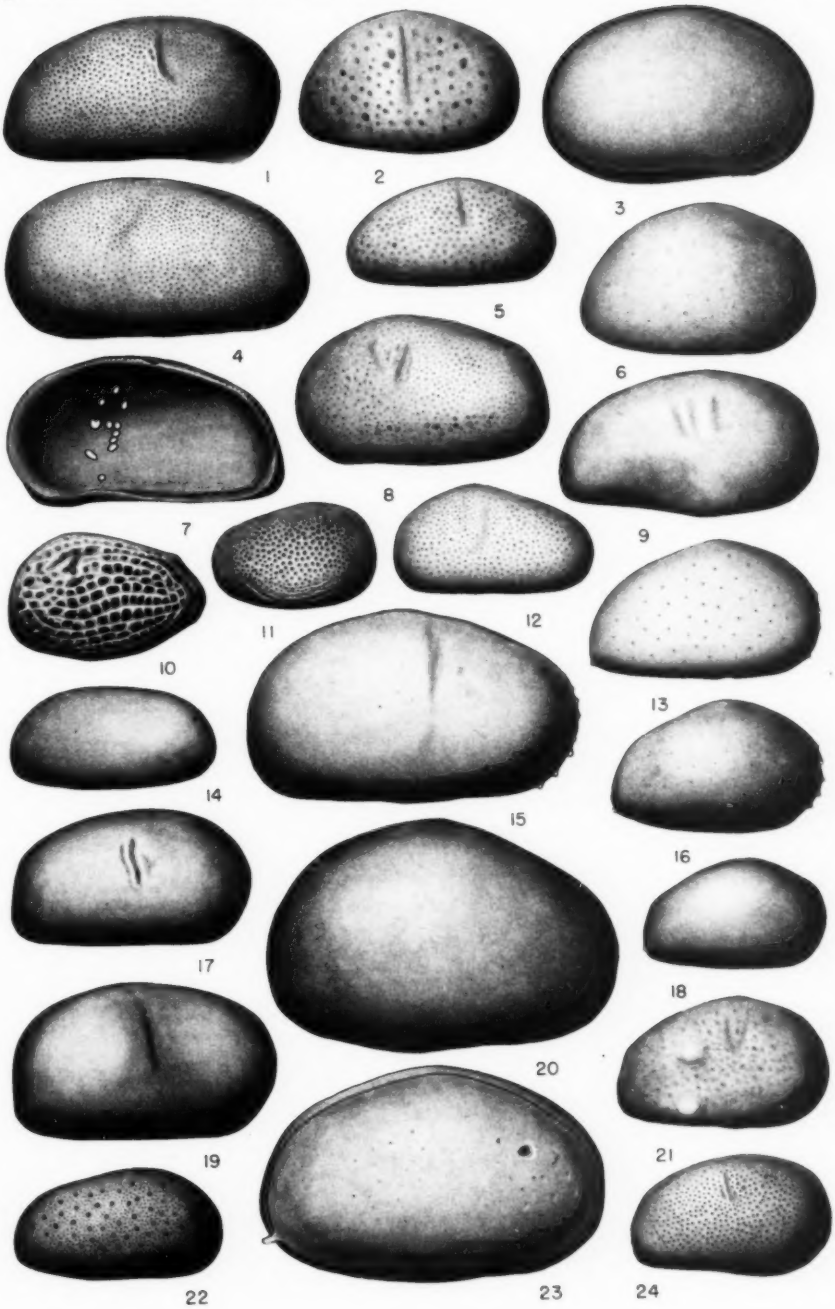
20—Cytheridea (*Haplocytheridea*) *ponderosa* Stephenson, n. sp. Lateral view of right valve. (p. 133)

21—Cytheridea (*Leptocytheridea*) *nodosa* Stephenson, n. sp. Lateral view of right valve. (p. 138)

22—Cytheridea (*Haplocytheridea*) *bradyi* Stephenson, n. sp. Lateral view of right valve. (p. 129)

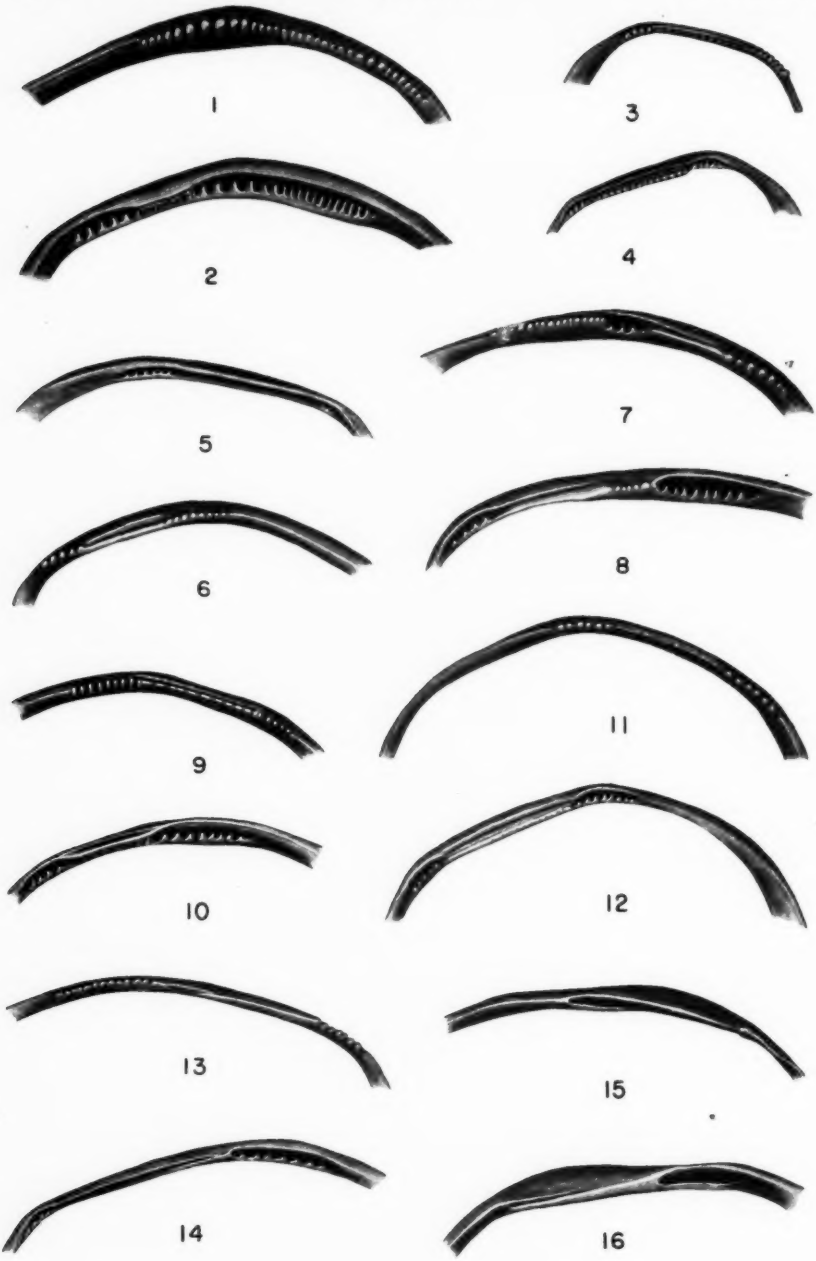
23—Cytheridea (*Haplocytheridea*) *subovata* Ulrich and Bassler. Right valve view, ×50. (p. 134)

24—Anomocytheridea mayi Stephenson, n. sp. Lateral view of right valve. (p. 144)



Stephenson, Tertiary Ostracodes

UNIV. OF MICH.



Stephenson, Tertiary Ostracodes

UNIV. OF MICH.

rounded anterior margin, and the somewhat more narrowly rounded posterior margin. Anterior end on many specimens bears six to eight short, fine, blunt spines, with a fewer number often occurring at the postero-ventral angle. Ventral margin somewhat convex, more strongly so in the larger left valve. Surface smooth, usually showing a moderate number of small pits, which mark the position of normal pore canals. Hinge in the right valve composed of elongate dentitions with about six to eight cusps, between which is a lower line of fine crenulations, separated from the dorsal margin by a faintly incised line. In the left valve, hinge with corresponding notched sockets, continuous with a crenulate connecting furrow. A slender bar above the groove is separated from the dorsal margin by a narrow, well-incised, depressed area. Six muscle scars are visible, four of which are in a vertical row, with the uppermost scar somewhat removed, and two more elongate, oblique scars are situated anterior to the row. Marginal areas rather narrow, with the line of concrescence coinciding with the inner margin throughout. About 35 simple radial pore canals are visible on the anterior.

Length 0.88 mm.; height 0.53 mm.; width 0.43 mm.

Remarks.—The hinge structure of *C.* (*H.*) *subovata*, which is typical for the subgenus *Haplocytheridea*, was well figured by Ulrich and Bassler (1904, pl. 37, figs. 2, 7), but indicated in the text merely as a "crenulated hinge." It was considered to be an intermediate type, on the basis of outline, between such forms as *Cytheridea mülleri* (Münster) and *C. perforata* (Roemer).

The species has previously been identified from the Shoal River Miocene of Florida by Howe and Hough (1935, p. 11). It is readily distinguished from *Anomocytheridea floridana*, a species from the *Arca* zone of the Choctawhatchee formation, in being more ovate, with a lower posterior cardinal angle, and a much simpler hinge structure and muscle scar pattern.

Occurrence.—The range of the species in the Florida Miocene is from the Chipola formation through the Oak Grove and Shoal River formations. It is a common member of the faunas at Locs. 3–7.

Types.—Hypotypes, H. V. Howe coll., no. 1547, complete specimen from Loc. 7; nos. 1548, 1549, from Loc. 4.

Subgenus LEPTOCYTHERIDEA Stephenson, 1937

The small, fragile species of the subgenus *Leptocytheridea* are present in

---

EXPLANATION OF PLATE 24

All figures ×75, unless otherwise indicated

FIGS. *1, 2*—*Cytheridea* (*Haplocytheridea*) *ponderosa* Stephenson, n. sp. *1*, Hinge of right valve. *2*, Hinge of left valve. Both figures ×60. (p. 133)

3, 4—*Perissocytheridea matsoni* (Stephenson). *3*, Hinge of right valve. *4*, Hinge of left valve. (p. 145)

5, 6—*Cytheridea* (*Haplocytheridea*) *bradyi* Stephenson, n. sp. *5*, Hinge of right valve. *6*, Hinge of left valve. (p. 129)

7, 8—*Anomocytheridea floridana* (Howe and Hough). *7*, Hinge of right valve. *8*, Hinge of left valve. Both figures ×60. (p. 142)

9, 10—*Cytheridea* (*Haplocytheridea*) *subovata* Ulrich and Bassler. *9*, Hinge of right valve. *10*, Hinge of left valve. (p. 134)

11, 12—*Cytheridea* (*Leptocytheridea*) *gunteri* Stephenson, n. sp. *11*, Hinge of right valve. *12*, Hinge of left valve. (p. 137)

13, 14—*Cytheridea* (*Leptocytheridea*) *choctawhatcheensis* Howe and Stephenson. *13*, Hinge of right valve. *14*, Hinge of left valve. (p. 137)

15, 16—*Cytherideis ashermani* Ulrich and Bassler. *15*, Hinge of right valve. *16*, Hinge of left valve. Both figures ×60. (Hypotypes, H. V. Howe coll., nos. 1537, 1538, from Chipola Miocene, Loc. 7.) (p. 128)

nearly all of the Tertiary sediments of the Gulf Coast. The present study has added eight new species, and has shown members of the subgenus to have a comparatively limited stratigraphic range. As the ornamentation of the carapace is weak or lacking entirely, and shape of the valves often very similar, correct specific assignments are at times very difficult. An attempt has been made to indicate diagnostic features for the separation of new species, as well as means of differentiating them from known species of the subgenus previously described. Outline ink drawings have been included to indicate the shape of valves not otherwise figured.

CYTHERIDEA (LEPTOCYTHERIDEA) CHIPOLENSIS Stephenson, n. sp.

Plate 23, figure 18; Text figure 5

Carapace tumid, in side view subpyriform, highest slightly anterior to the middle, thickest somewhat posterior to the middle. Left valve larger and more broadly rounded than the right. Dorsal margin gently arched; ventral margin slightly convex. Anterior end broadly rounded; posterior end much narrower to the rounded postero-ventral angle. Surface smooth, showing an occasional small, slightly depressed pit. Hinge in the right valve composed of elongate terminal dentitions, notched to form 8 to 10 small cusps. A slender, well-intrenched, crenulate groove connects the dental areas, being most prominent immediately behind the anterior dentition, and becoming less pronounced as it approaches the posterior dentition. The dorsal margin forms a low, narrow bar between the dental areas and above the groove. In the left valve, hinge consists of notched, well-incised sockets, between which is a slender, crenulate, connecting bar which is highest adjacent to the anterior socket, and becomes obscure as it approaches the posterior socket. A shallow, fairly broad depressed area is visible between the bar and the dorsal margin, being most clearly defined toward the posterior. Marginal areas very narrow, carrying about 15 short, straight radial pore canals on the anterior.

Length (right valve) 0.62 mm.; height 0.36 mm.

Remarks.—Adult specimens of *C.* (*L.*) *chipolensis* are smaller than fully developed specimens of *C.* (*L.*) *waltonensis*, a very similar species from the Shoal River formation. The posterior cardinal angle is somewhat more sharply defined, and the posterior end slopes somewhat more steeply. *C.* (*L.*) *chipolensis* is also a smaller form than *C.* (*L.*) *okaloosensis* from the overlying Oak Grove formation, and the ventral margin is straighter to the postero-ventral angle. The posterior end is also less broadly rounded, and the anterior and posterior spines characterizing the Oak Grove form are absent.

C. (*L.*) *chipolensis* is quite easily separated from the species of *Leptocytheridea* occurring lower in the Gulf Coast section. *C.* (*L.*) *byramensis* Stephenson (1936a), which was described from the Byram marl Oligocene of Louisiana, is smaller, with a more strongly convex ventral margin which is somewhat sinuated in the posterior half; the posterior cardinal angle is somewhat more pronounced, and the postero-ventral angle much more pointed. *C.* (*L.*) *kellumi* Howe and Stephenson (1935a), described from the *Massilina pratti* zone of the upper Jackson Eocene, is also much smaller and much more fragile; in side view it is much lower and more elongate, with the ventral margin sinuated in the posterior half, and the posterior end more steeply sloping to the pointed, spinose postero-ventral angle.

Occurrence.—The species is limited in my collections to the Chipola formation at Loc. 7, at which station it is abundant.

Types.—Syntypes, H. V. Howe coll., nos. 1521, 1522, from the Chipola formation, Loc. 7.

CYTHERIDEA (LEPTOCYTHERIDEA) CHOCTAWHATCHEENSIS Howe and Stephenson

Plate 23, figure 9; Plate 24, figures 13, 14; Text figures 12, 17, 18

Cytheridea choctawhatcheensis HOWE and STEPHENSON, *1935*, Florida Dept. Cons., Geol. Bull. 13, pp. 9, 10, pl. 2, fig. 11; pl. 4, fig. 9.

This small, smooth species is here assigned to the subgenus *Leptocytheridea*. The hinge structure is completely figured for the first time (pl. 24, figs. 13, 14), and the original description of the hinge is quoted.

The hinge of the right valve consists of a faint row of denticulations just anterior to the middle, behind which the dorsal margin is grooved for a short distance and then it becomes sharply prominent to the postero-dorsal angle. The hinge of the left valve consists of a narrow, elongate, notched socket anterior to the middle, behind which is a short, raised bar and behind that the dorsal margin is faintly grooved to the postero-dorsal angle.

Length (right valve) 0.88 mm.; height 0.49 mm.

Remarks.—The low, elongate outline of the valves of *C.* (*L.*) *choctawhatcheensis* in side view, as well as the size of the carapace, which is large for the subgenus, tend to separate it from other members of the subgenus. An added diagnostic feature is the rising, incurved posterior half of the ventral margin in the right valve.

Occurrence.—The range of the species, as given by Howe and Stephenson (1935), was Chipola through the *Arca* zone of the Choctawhatchee. It is here restricted to the *Arca* zone of the Choctawhatchee formation, and the forms previously included with it are described as new species.

Types.—Hypotypes, H. V. Howe coll., nos. 1529, 1530, from Loc. 2.

CYTHERIDEA (LEPTOCYTHERIDEA) GUNTERI Stephenson, n. sp.

Plate 23, figure 6; Plate 24, figures 11, 12; Text figures 1, 16

Carapace tumid, rather heavy for this subgenus; in side view high in comparison to the length, with the greatest height at or slightly anterior to the middle. Anterior end broadly and evenly rounded, gently rising to the anterior cardinal angle, which is located at about the midpoint of the shell length, and represents the greatest height of the carapace. Several very short, inconspicuous, blunt spines are often very weakly developed on the ventral one-third of the anterior end of the right valve. From the anterior cardinal angle, the hinge line is slightly convex and sloping toward the posterior. Posterior end much narrower than the anterior, and bluntly truncated from the weak posterior cardinal angle to the rounded postero-ventral angle. Ventral margin weakly convex. Surface smooth except for moderately small, shallow, equidistant pits on tumid portions of the carapace wall, marking the position of the fairly numerous normal pore canals. Hinge structure weak (pl. 24, figs. 11, 12; text fig. 1); in the right valve composed of slightly raised, faintly notched, terminal dental areas, which slope gradually into a slender, shallow, minutely crenulate groove between them, which is outlined dorsally by a slightly raised bar. In the left valve, hinge with weakly incised, notched terminal sockets, with a faintly notched bar between and truncated into them. Between bar and dorsal margin is a shallow depressed area. Marginal areas very narrow and inconspicuous, carrying about 15 short, straight, radial pore canals on the anterior.

Length (right valve) 0.80 mm.; height 0.53 mm.

Remarks.—*C.* (*L.*) *gunteri* is quite easily distinguished from other known species in the Gulf Coast Tertiary by its more broadly rounded outline in side view, and its comparatively greater height with respect to length.

Named in honor of Herman Gunter, Assistant Supervisor, Florida State Board of Conservation, Geological Department.

Occurrence.—In my collections this species is confined to Loc. 1, in the Caloosahatchee marl, Pliocene, from which station it is described.

Types.—Holotype (pl. 23, fig. 6), H. V. Howe coll., no. 1527; paratype (left valve), no. 1528.

CYTHERIDEA (LEPTOCYTHERIDEA) MARIANNENSIS Stephenson, n. sp.

Plate 23, figure 12

Carapace small, fragile, in side view subpyriform, greatest height somewhat anterior to the middle, greatest inflation at about the posterior one-third the shell length. Dorsal margin weakly arched, sloping gently toward the posterior. Ventral margin straight or somewhat sinuated. Anterior end broadly and evenly rounded; posterior end well rounded, but more narrowly so than the anterior, to the rounded postero-ventral angle. Entire surface covered with small, closely spaced pits, the pitting becoming obscure toward the periphery. A somewhat oblique, fairly well-defined median vertical sulcus is visible in the dorsal half of both valves, in some specimens becoming a broadened depressed area. Immediately posterior to this depression, the valves are somewhat more strongly inflated than elsewhere, producing the greatest thickness at this point. Hinge structure very fragile; in the right valve with elongate, slightly elevated, faintly notched terminal dental areas, the anterior more prominent than the posterior. The anterior dentition is truncated into a slender groove immediately behind it, which is visible to about the mid-point of the hinge. The low, narrow dorsal margin extends above the groove to this point, where it becomes more prominent, rising gradually and forming the hinge line to the point where it merges with the posterior dentition. Hinge in the left valve with slender, notched terminal sockets. A narrow bar, immediately behind the anterior socket and highest adjacent to it, extends to about the mid-point of the hinge line, where it becomes obscure. A faintly defined groove is visible at this point, becoming slightly more prominent as it approaches and finally merges with the posterior socket. Marginal areas very narrow, carrying about 15 short, straight radial pore canals on the anterior.

Length (left valve) 0.69 mm.; height 0.38 mm.

Remarks.—The low, elongate outline of this species, together with its very fine, closely spaced pitting, serve to readily distinguish it from other Miocene species of the subgenus *Leptocytheridea*. The more fragile hinge line, narrow marginal areas, and delicate shell wall separate it from *C.* (*H.*) *bradyi* in the Caloosahatchee marl, and from *C.* (*H.*)*gardnerae*, with which it occurs in the Chipola formation.

Named for the town of Marianna, Calhoun County, Fla., near which the type material was collected.

Occurrence.—The species is comparatively rare in the Chipola Miocene of Florida. Figured specimens are from Loc. 7, which is the only station at which I have observed the species.

Types.—Syntypes, H. V. Howe coll., nos. 1531, 1532.

CYTHERIDEA (LEPTOCYTHERIDEA) NODOSA Stephenson, n. sp.

Plate 23, figure 21

Carapace small, thin; in side view subpyriform, with the greatest height at about the middle. Anterior end broadly and evenly rounded; posterior end narrow, steeply sloping from the low posterior cardinal angle to the slightly rounded postero-ventral angle. Dorsal margin rises gently to the obscure anterior cardinal angle, from which point it slopes much more steeply, in a convex curve, to the low posterior cardinal angle; ventral margin straight to slightly sinuated. Surface smooth, showing a slightly granular appearance under higher magnifications. A slightly depressed, somewhat oblique, vertical median sulcus extends from the mid-point of the shell a short distance toward the dorsal margin. Two fairly distinct nodes are visible, vertically situated one above the other at the posterior one-third of the length of the shell. The lower protuberance is about one-fifth the shell height above the ventral margin, while the

upper is removed from it by about two-fifths the shell height. Hinge in the right valve composed of slender, elongate, faintly notched dentitions which slope gradually into a very narrow connecting groove which becomes obscure toward the mid-point of the hinge line. A slender bar defines the groove dorsally, becoming more prominent toward the posterior to the point where it joins the posterior dentition. Hinge in the left valve with slender, notched sockets, with a narrow bar between them which is most prominent on the anterior.

Length (right valve) 0.69 mm.; height 0.43 mm.

Occurrence.— *C.* (*L.*) *nodosa* is confined in my collections to the Caloosahatchee marl, Pliocene, where it is exceedingly rare.

Types.—Holotype (right valve), H. V. Howe coll., no. 1533; paratype (left valve), no. 1534. Both specimens were collected at Loc. 1.

CYTHERIDEA (LEPTOCYTHERIDEA) OKALOOSENSIS Stephenson, n. sp.

Plate 23, figure 16; Text figure 8

Carapace short, thin, tumid; in side view subpyriform, highest slightly anterior to the middle. Dorsal margin well arched, with the hinge line flattened and sloping toward the posterior; ventral margin convex. Anterior end broadly rounded, usually bearing several small, short, blunt spines on the ventral half; posterior end narrow, sloping steeply from the obscure posterior cardinal angle to the rounded postero-ventral angle, which often bears one or more spines similar to those on the anterior. Surface smooth, except for a moderate number of small, fairly deep pits, which mark the position of normal pore canals. Hinge in the right valve with narrow, elongate dental areas. The anterior dentition is truncated into a slender, faintly notched groove immediately behind it, which is outlined dorsally by the narrow, low dorsal margin. At about the mid-point between the two dentitions, the groove becomes obscure, and the dorsal margin forms the hinge line to the posterior dentition. In the left valve, hinge with notched terminal sockets, between which is a narrow, well-elevated bar, which is most prominent on the anterior, and which slopes into a slight groove near the posterior socket. The bar is separated from the dorsal margin by a narrow depressed area. Marginal areas very narrow, carrying about 10 short, straight radial pore canals on the anterior.

Length (right valve) 0.71 mm.; height 0.44 mm.

Remarks.—*C.* (*L.*) *okaloosensis* is larger in the adult, with a more broadly rounded outline in side view than *C.* (*L.*) *chipolensis* from the underlying Chipola formation. *C.* (*L.*) *okaloosensis* is also quite similar to *C.* (*L.*) *waltonensis* from the overlying Shoal River formation, but is less elongate, with a broader, more steeply sloping posterior end, and a stronger upward curve of the ventral margin at the postero-ventral angle.

Occurrence.—The species is confined in my collections to the Oak Grove formation. It is very common at Loc. 6, from which station it is described.

Types.—Syntypes, H. V. Howe coll., nos. 1523, 1524.

CYTHERIDEA (LEPTOCYTHERIDEA) SULCATA Stephenson, n. sp.

Plate 23, figure 2

Carapace tumid, in side view subpyriform, highest at about the center. Dorsal margin moderately arched, passing in an even curve into the well-rounded anterior end and the somewhat more narrowly rounded posterior end. Ventral margin convex, more strongly so in the larger left valve. Tumid portion of the carapace covered with fairly closely spaced, rather deep pits of moderate size, the pitting becoming obscure toward the periphery. A pronounced, broad, somewhat oblique, median vertical sulcus extends from a point near the dorsal margin to about the mid-point of the carapace. This depression is flanked on the posterior by a fairly strongly elevated, vertically elongated expansion of the side wall of the shell. Hinge in the right valve with

slender, notched, terminal dental areas, which slope into a narrow, finely crenulate groove immediately below the dorsal margin. In the left valve, hinge with corresponding notched sockets, connected by a slender, faintly notched bar which is separated from the dorsal margin by a faintly incised line. Marginal areas so narrow that they constitute little more than the thickness of the shell. Radial pore canals not visible.

Length (right valve) 0.73 mm.; height 0.48 mm.

Remarks.—*C.* (*L.*) *sulcata* is closely allied to *C.* (*L.*) *gunteri*, with which it occurs at the type locality, and it seems probable that both have evolved from a common parent stock. The two species are readily separable, however, as *C.* (*L.*) *sulcata* is much lower at its maximum height, in addition to its having the vertical sulcus and posterior inflation.

Occurrence.—This species is very rare in the Caloosahatchee marl, Pliocene, at Loc. 1, from which station it is described. I have not observed it at any other locality.

Types.—Holotype (right valve), H. V. Howe coll., no. 1535; paratype, no. 1536.

CYTHERIDEA (LEPTOCYTHERIDEA) WALTONENSIS Stephenson, n. sp.

Plate 23, figure 13; Text figure 15

Carapace tumid, thin, fragile; in side view subpyriform, highest somewhat anterior to the middle. Dorsal margin well arched, nearly straight along the hinge line, sloping down from the well-defined anterior cardinal angle to the low, obscure posterior cardinal angle; ventral margin nearly straight, slightly convex. Anterior end broadly rounded, usually bearing four or five very short, blunt, inconspicuous spines on the ventral half of the right valve; posterior end steeply sloping to the somewhat rounded postero-ventral angle, which often bears one slender, short, blunt spine, and one or two obscure, shorter spines on the right valve. Surface smooth, exhibiting a limited number of rather widely spaced, small, shallow, indistinct pits where normal pore canals come to the surface. Hinge in the right valve with slender, terminal dental areas, the anterior distinctly notched into about 10, and the posterior into about six cusps. An intrenched, narrow, faintly crenulate groove behind the anterior dentition is terminated dorsally by the low bar of the dorsal margin. The groove becomes obscure at the mid-point of the hinge, from which point to the posterior dentition the dorsal margin is more pronounced. Hinge in the left valve with well-incised, notched terminal sockets, between which is a narrow, slightly notched bar, which is most prominent on the anterior and which slopes into a slight groove near to and connected with the posterior socket. The bar is separated from the dorsal margin by a faintly depressed area. Marginal areas very narrow, bearing a few short, straight, radial pore canals.

Length (right valve) 0.78 mm.; height 0.46 mm.

Remarks.—*C.* (*L.*) *waltonensis*, from the Shoal River formation, may easily be confused with *C.* (*L.*) *chipolensis* from the Chipola, to which it is closely similar. Adult specimens of the Shoal River form are considerably larger, and show a slight development of anterior and posterior spines. The slope of the hinge line is somewhat less, and the posterior cardinal angle somewhat less pronounced. *C.* (*L.*) *waltonensis* is longer, and is arched to a somewhat sharper anterior cardinal angle than is *C.* (*L.*) *okaloosensis* from the Oak Grove, the hinge line is somewhat more convex, the posterior cardinal angle more obscure, and the posterior end narrower and slightly less steeply truncated. It appears probable that *C.* (*L.*) *waltonensis* was evolved from *C.* (*L.*) *okaloosensis*, which in turn developed from *C.* (*L.*) *chipolensis*. The separation of these three species is probably too exacting to be applicable to most economic work.

Occurrence.—This species has been observed by me only in the Shoal River formation, where it is comparatively

rare. Figured specimens are from Loc. 4.

Types.—Syntypes, H. V. Howe coll., nos. 1525, 1526.

Genus ANOMOCYTHERIDEA Stephenson, n. gen.

Genotype, *Cytheridea floridana* Howe and Hough.

In describing the ostracode assemblage of the *Potamides matsoni* zone from its type locality near Alexandria, Rapides Parish, La. (Stephenson, 1935), I find that my description of *Cytheridea locketti* was too generalized. It could cover two closely allied species present at the type locality, as well as several other very similar species which occur with *Rangia johnsoni*. A careful examination of hundreds of specimens from wells in southern Louisiana has shown the form which I originally considered as *Cytheridea locketti* to be a genus rather than a species. The species is here restricted, and assigned to the genus *Anomocytheridea*. The right valve, which I figured as syntype no. 1407, possesses a feature which easily separates it from all other species of *Anomocytheridea* that I have seen, a feature which I did not note at the time of description. This diagnostic feature is the possession of anterior and posterior ventral flanges on the right valve.

Of the three species of ostracodes which I described from the type locality of the *Potamides matsoni* zone, *Anomocytheridea locketti* appears to have the most restricted range, *Perissocytheridea matsoni* and *Microcythere moresiana* being found along with *Rangia johnsoni*. The two species of *Anomocytheridea* which occur with *Rangia johnsoni* may both be separated from *A. locketti* through the absence of the flanges. The term "*Potamides matsoni* zone ostracode assemblage," a term which has crept into the literature, should probably therefore be abandoned in favor of such a term as "*Anomocytheridea locketti* zone."

The genus *Anomocytheridea* is close to the genus *Cytheridea* in its general shell characters, but differs so markedly in the features of the hinge line and muscle-scar pattern that it appears necessary to erect a new genus. In side view the carapace is subovate, with the left valve larger and overlapping the right. The anterior end is broadly and evenly rounded, while the posterior end is somewhat more narrowly rounded. The ornamentation is weakly developed in known species, the surface being smooth or pitted. The hinge structure (pl. 24, figs. 7, 8) in the right valve is composed of an elongate dental area anterior to the middle, notched to form a number of fine crenulations. Immediately behind this dentition is an elongate socket, which may be faintly denticulate. The hinge line behind the socket is composed of a slender bar, which rises toward the posterior, where it is broken into a dentition similar to that on the anterior except for the fewer number of cusps forming it. The hinge of the left valve possesses a long, well-incised, deeply notched socket on the anterior, which is terminated posteriorly by a pronounced, elongate tooth-like elevation. Behind this elevation, the hinge is grooved and finely crenulate to the short, notched, posterior socket. The muscle scar area (pl. 23, fig. 7) consists of a vertical row of four small scars, with two more on a horizontal line anterior to the uppermost scar in the row; two more scars to the ventral and three to the dorsal side of this group, which are more widely separated, complete the pattern. The marginal areas are of moderate width, and bear numerous fairly straight radial pore canals.

I have chosen *Cytheridea floridana* Howe and Hough, a species from the *Arca* zone of the Choctawhatchee (Miocene) formation of Florida, as the type of the genus. The type species has been found to occur in marine assemblages. My observations so far show that other species of the genus occur in brackish water upper and middle Miocene sediments.

ANOMOCYTHERIDEA FLORIDANA (Howe and Hough)

Plate 23, figure 15; Plate 24, figures 7, 8; Text figures 2, 6, 19, 20

Cytheridea floridana HOWE and HOUGH, *1935*, Florida Dept. Cons., Geol. Bull. 13, pp. 10, 11, pl. 2, figs. 15, 16, 18; pl. 4, figs. 6, 10.

Carapace tumid, in side view subovate, highest at or near the middle. Left valve larger and overlapping the right. Dorsal margin gently arched, with weak cardinal angles. Ventral margin slightly convex, or somewhat sinuated. Anterior end broadly and evenly rounded, usually bearing several short, blunt spines on the right valve; posterior end bluntly truncated to the rounded postero-ventral angle. Exterior of the carapace nearly smooth, showing numerous small, shallow pits which mark the position of normal pore canals. A faintly depressed, somewhat oblique vertical sulcus is usually visible on the dorsal half of the carapace, somewhat anterior to the middle. Hinge structure (pl. 24, figs. 7, 8) well developed; in the right valve consisting of a long, slender, well-elevated taxodont dental area, anterior to the middle, and extending almost to the mid-point of the carapace length, where it is abruptly truncated into a fairly deep, ovate depression which is faintly denticulate. Immediately behind this socket, the hinge is formed by a slender bar, which becomes gradually higher toward the posterior and faintly denticulate, merging with the short, down-curved, notched posterior dentition at the posterior cardinal angle. In the left valve, an elongate, well-incised, notched socket is present on the anterior, corresponding to and receiving the long anterior dentition of the right valve. Behind the socket is a short, tooth-like elevation, usually faintly cut into several cusps, which is terminated by a well-incised groove extending to the strongly depressed, curved notched posterior socket. A faint groove or lip line inside the ventral margin on the anterior half of the left valve, with a slight incurved flange over it, is fitted to receive the ventral margin of the right valve, which is incurved at its mid-point. Marginal areas fairly broad on the anterior and carrying about 35 radial pore canals; on the posterior narrow and steeply shelving toward the interior, with fewer pore canals. The line of concrescence coincides with the inner margin throughout. Muscle-scar pattern complex (text fig. 6).

Length (right valve) 1.11 mm.; height 0.63 mm. Length (left valve) 1.14 mm.; height 0.65 mm.

Remarks.—As I have noted, this species has been observed only in marine sediments. It is the most common of the Ostracoda of the *Arca* zone of the Choctawhatchee formation of Florida, and an excellent index fossil for this horizon. The more complex hinge structure of *A. floridana* readily separates it from *C.* (*H.*) *subovata* Ulrich and Bassler, a very similar form in the Shoal River formation of Florida.

Types.—Hypotypes, H. V. Howe coll., nos. 1554, 1555, from Loc. 2.

ANOMOCYTHERIDEA INORNATA Stephenson, n. sp.

Plate 23, figures 17, 19; Text figure 14

Carapace in side view subovate, highest at about the middle. Dorsal margin weakly arched; ventral margin almost straight in the right valve, somewhat convex in the left valve. Anterior end broadly rounded; posterior end narrower, and sloping steeply to the somewhat rounded postero-ventral angle. Surface smooth except for pits which are weakly developed where the fairly numerous normal pore canals reach the surface, some specimens showing an almost complete absence of pitting. Hinge in the right valve composed of a long, slender anterior dentition, highest on its anterior end, and faintly notched to form about 14 cusps. A weakly developed, elongated socket is visible immediately behind the anterior dentition. The socket is followed by a slender bar, which rises toward the posterior to join the posterior dental area, which is short, and broken

into about six small cusps. In the left valve, hinge with a long, moderately depressed, faintly notched anterior socket. An elevated, knob-like tooth is visible behind the socket. Immediately behind the tooth is a faintly depressed groove which broadens and deepens to form the notched posterior socket. Marginal areas rather narrow, bearing about 35 radial pore canals on the anterior. Muscle-scar pattern identical with that of the genotype, *A. floridana*.

Length (male right valve) 0.81 mm.; height 0.45 mm.

Remarks.—This species is very similar to *A. locketti*, with which it occurs at the type locality of the *Potamides matsoni* zone. *A. inornata* is most easily distinguished through the absence of pronounced pitting on the exterior of the carapace, through the lack of anterior and posterior ventral flanges on the right valve, and through its less strongly developed hinge structure. The new species has a shorter, more fragile carapace and weaker development of the hinge line than *A. floridana*.

Sexual dimorphism is rather pronounced in this species. The female (pl. 23, fig. 19) shows a much stronger posterior inflation, which is most pronounced somewhat dorsal to the midpoint of the height. The posterior cardinal angle is also considerably higher in the female, with the posterior end more steeply sloping, and in some specimens almost vertical.

Occurrence.—*A. inornata* is fairly abundant at Loc. 8, the type locality of the *Potamides matsoni* zone, Rapides Parish, La. I have not observed it from any other outcrop sample.

Types.—Holotype (male right valve), H. V. Howe coll., no. 1556; paratypes, nos. 1557–1560. All specimens are from Loc. 8.

ANOMOCYTHERIDEA LOCKETTI (Stephenson)
Plate 23, figures 1, 4, 7, 8

Cytheridea locketti STEPHENSON, *1935*, Louisiana Dept. Cons., Geol. Bull. 6, pp. 193, 196, pl. 5, figs. 10–13.

Carapace in side view elongate, subovate, highest at or slightly anterior to the middle. Anterior end broadly rounded, posterior end steeply sloping to the rounded postero-ventral angle. Dorsal margin weakly arched, sloping gently from the obscure anterior cardinal angle to the lower, more pronounced posterior cardinal angle. Ventral margin nearly straight. A diagnostic characteristic of the species is visible on the ventral margin of the right valve, consisting of a thickened flange of clear shell material extending from the anterior ventral angle a short distance toward the posterior, and produced somewhat below the general line of the ventral margin. The postero-ventral angle likewise exhibits a flange-like thickening of the shell material on the right valve, though far less pronounced than the similar feature on the anterior of the valve. Available specimens of the left valve show the flanges to be entirely lacking. Tumid portions of the shell wall closely covered with small, fairly deep pits, the pitting being usually more pronounced on the posterior half of the carapace, and tending to become less marked toward the periphery. Hinge in the right valve consisting of a long, slender, bar-like dentition, faintly notched to form about 12 teeth, with an elongate, faintly crenulate pit immediately posterior to it. A slender, slightly raised bar is visible around the dorsal side of the pit, and is continuous with the bar forming the hinge line from the pit to the point where it gently rises to merge with the posterior dentition, which is short and divided into about six cusps by faintly impressed vertical notches. Hinge in the left valve with a well-incised, long, notched anterior socket for the reception of the anterior dentition. An elevated, elongate protuberance behind the socket is truncated into a slender, shallow groove, which becomes more pronounced posteriorly to the point where it broadens to form the short, notched posterior socket. A low, narrow bar is visible above the groove. Muscle-

scar pattern complex, and typical for the genus.

Length (male right valve, excluding ventral flange) 0.91 mm.; height 0.48 mm. Length (male left valve) 1.00 mm.; height 0.55 mm. Length (female left valve) 0.86 mm.; height 0.52 mm.

Remarks.—As I noted under the generic description of *Anomocytheridea*, *A. locketti* as here restricted differs from all other species of the genus known to me in the possession of anterior and posterior ventral flanges on the right valve. The species is further to be distinguished from *A. inornata*, with which it occurs at the type locality, by the pits which closely cover the tumid portion of the carapace wall.

Occurrence.—The species is comparatively rare at the type locality of the *Potamides matsoni* zone, which is the only surface sample in which I have observed it.

Types.—Hypotypes, H. V. Howe coll., nos. 1561, 1562; syntype, no. 1408 (pl. 23, fig. 8).

ANOMOCYTHERIDEA MAYI Stephenson, n. sp.

Plate 23, figure 24; Text figure 9

Carapace thin, fragile; in side view elongate, subpyriform, with the greatest height slightly anterior to the middle. Anterior end broadly and evenly rounded; posterior end steeply truncated to the postero-ventral angle, which is subacute and often faintly produced below the ventral margin in the right valve, and rounded in the left valve. Dorsal margin weakly arched, flattened along the hinge line, and sloping toward the posterior. Ventral margin in the right valve straight, weakly sinuated in the posterior half; in the left valve slightly convex. Tumid portions of the carapace ornamented with numerous closely spaced, very fine pits; pitting becomes obscure toward the periphery, leaving the peripheral area entirely smooth and imperforate. A weakly developed, somewhat oblique, median vertical sulcus is usually visible extending from about the mid-point of the carapace a short distance toward the ventral margin. Hinge structure very delicate; in the right valve consisting of slender, elongate dental areas, notched to form about five minute cusps. A faintly incised, narrow, elongate socket immediately behind the anterior dentition is followed by a narrow, low bar, which becomes more prominent as it approaches and finally merges with the posterior dentition. In the left valve, hinge with fairly well-incised, faintly notched terminal sockets, the anterior the longer and more prominent. A narrow, slightly raised, elongate elevation immediately behind the anterior socket gives way to a weakly intrenched groove, which becomes more prominent toward the posterior and joins the posterior socket. The groove is defined dorsally by a weakly developed, slender bar. Marginal areas very narrow, carrying a moderate number of short, straight radial pore canals on the ventral half of the anterior margin.

Length (right valve) 0.69 mm.; height 0.39 mm.

Remarks.—This species is much smaller and shorter than *A. locketti*, it is more strongly inflated, and lacks the ventral flanges. It is likewise smaller than *A. inornata*, and the pitted exterior of the carapace wall makes it easily distinguishable. The hinge structure and pitting pattern readily set it apart from species of *Leptocytheridea* with which it might be confused.

Named in honor of George N. May, Louisiana Geological Survey.

Occurrence.—*A. mayi* is restricted in my collections to Loc. 8, the type locality of the *Potamides matsoni* zone. It occurs in moderate abundance at this station.

Types.—Syntypes, H. V. Howe coll., nos. 1563, 1564, from Loc. 8.

Genus PERISSOCYTHERIDEA Stephenson, n. gen.

Genotype, *Cytheridea* (?) *matsoni* Stephenson.

In a former paper describing some of

the microfossils from the *Potamides matsoni* zone of Louisiana (Stephenson, 1935), I included one species, *Cytheridea* (?) *matsoni*, which was questionably referred to the genus *Cytheridea*. The present study has disclosed the presence of another species, here described as *Perissocytheridea gracilis*, the shell characters of which are similar to those of *C.* (?) *matsoni*. While very close in some respects to forms included under the genus *Cytheridea*, these two species are markedly different from that genus with respect to some of their shell characters. The new genus *Perissocytheridea* is here proposed to include these two, the only species at present known to me possessing a similar shell structure.

The carapace of members of the new genus is tumid, small, and fragile. In side view, the shell is subpyriform, with the greatest height anterior to the middle. The anterior end is broadly rounded, the posterior end rounded or subacute, with the postero-ventral angle removed from the ventral margin about one-third to one-half the height of the carapace. The dorsal margin is straight or weakly convex, and slopes toward the posterior from the high anterior cardinal angle. The ventral margin shows considerable convexity. The ornamentation of known species consists of pits. Viewed from the inside, the interior of the valves is deep. The hinge structure shows decided affinities to that of the subgenus *Clithrocytheridea* of the genus *Cytheridea*. In the right valve the hinge consists of slender, elongate, well-elevated, terminal taxodont dental areas at the cardinal angles, divided into cusps by vertical notches. These dentitions are steeply truncated into an incised connecting groove which is continuous between them, and which is terminated dorsally by the low bar of the dorsal margin. The complimentary hinge line of the left valve is composed of well-incised, notched sockets for the reception of the terminal dentitions of the right valve. A slender, well-defined bar forms the hinge between the sockets, which is separated from the dorsal margin by a faintly incised line. The line of concrescence is coincident with the inner margin except on the anterior and posterior ends, where it swings out into the marginal areas to a point about midway between inner and outer margins. The muscle-scar pattern of the genus is totally obscured by the opacity of available specimens and the exterior ornamentation.

Remarks.—The hinge structure of the genus *Perissocytheridea* is very similar to that of the subgenus *Clithrocytheridea* of the genus *Cytheridea* (see Stephenson, 1936, pl. 94, figs. 5, 6). The new genus is distinct, however, in its general outline when viewed from the side, and the very small, thin, delicate shell sets it definitely apart from the large, heavy, strongly ornamented species of *Clithrocytheridea*. The outline of the valves of the new genus is likewise distinct from the subgenus *Leptocytheridea*. The marginal areas are also considerably wider, and the hinge line, while similar, is much stronger, with a greater development of the bar connecting the anterior and posterior sockets of the left valve. The small fragile species of *Perissocytheridea* are also distinct from the larger, heavier species of the subgenus *Haplocytheridea*, and the hinge line is radically different. The new genus is much smaller and exhibits a simpler hinge structure than that of the genus *Anomocytheridea*.

Range.—It is difficult to establish the range of the genus *Perissocytheridea*, due to the present disputed age of the *Potamides matsoni* zone in the Gulf Coast, and the uncertainty as to the exact point at which the genotype, *Perissocytheridea matsoni*, dies out in the stratigraphic sequence. The range of the genus is therefore here tentatively considered to be Miocene.

PERISSOCYTHERIDEA MATSONI (Stephenson)
Plate 23, figure 10; Plate 24, figures 3, 4;
Text figures 4, 7, 11

Cytheridea (?) *matsoni* STEPHENSON, *1935*, Louisiana Dept. Cons., Geol. Bull. 6, pp. 192, 193, pl. 5, figs. 1, 2, 7, 8.

Carapace small, fragile, tumid; in side view subpyriform, with the greatest height at the anterior one-third the length of the shell, and the greatest inflation, in male specimens, at about the middle. Anterior end broadly rounded to the high anterior cardinal angle; posterior end sloping steeply to the acute postero-ventral angle, which is situated about one-third the shell height above the lowest point of the ventral margin, and along the line of greatest length of the carapace. Dorsal margin straight or slightly convex along the hinge line, in the male with a pronounced slope to the posterior from the high anterior cardinal angle to the much lower posterior cardinal angle. Ventral margin rather strongly convex, hidden from side view in its central portion by the overhanging ventral inflation of the side wall. Surface ornamentation consists of fairly deep, closely spaced pits of moderate size, the pitting becoming finer and obscure toward the periphery, and leaving the peripheral area almost smooth. The area between pits stands out in relief, giving a tendency toward a reticulate pattern of slender ridges. A narrow, delicate ridge is visible on many specimens, starting near the ventral margin at a point about one-third the shell length from the posterior, where it is most prominent and sometimes carries a slight spine-like projection. The ridge extends from this point in a gentle upward curve, becoming less pronounced and finally entirely obscure near the anterior periphery. Hinge structure (pl. 24, figs. 3, 4; text fig. 4) in the right valve consists of slender, elongate, well-elevated anterior and posterior terminal dentitions, the former cut into about six and the latter into about four small cusps by faintly defined notches. A very finely notched groove between the dentitions is deep and pronounced immediately behind the anterior dental area, and becomes progressively shallower toward the posterior. The dorsal margin extends above the groove as a low, slender bar. In the left valve, well-incised, notched sockets at the cardinal angles are joined by a very faintly notched bar, which is highest and more strongly notched at its anterior end. Line of concrescence coincides with the inner margin except on the anterior and posterior, where it extends about midway between inner and outer margins. Radial pore canals straight, simple, about 15 in number on the anterior, with a fewer number on the posterior. Muscle-scar pattern too obscure to be determined with certainty.

Length (male right valve) 0.46 mm.; height 0.30 mm. Length (male left valve) 0.50 mm.; height 0.30 mm. Length (female left valve) 0.54 mm.; height 0.28 mm.

Remarks.—Sexual dimorphism is very strongly developed in this species. In lateral view, the female (text fig. 11) is subovate, with the posterior cardinal angle nearly as high as the anterior, and dorsal and ventral margins are subparallel. The posterior inflation of the carapace is pronounced, and most strongly developed somewhat dorsal to the mid-point of the shell height. The postero-ventral angle is much more blunt in the female than in the male.

Occurrence.—*Perissocytheridea matsoni* is fairly common at Loc. 8, the type locality of the *Potamides matsoni* zone, Rapides Parish, La. This is the only surface sample in my collections in which the species occurs, although it has been observed in the subsurface in numerous well samples from the zone.

Types.—Hypotypes, H. V. Howe coll., nos. 1550, 1551. Syntypes, nos. 1401, 1402 (text figs. 7, 11). All specimens from Loc. 8.

PERISSOCYTHERIDEA GRACILIS Stephenson, n. sp.
Plate 23, figure 11

Carapace tumid, in side view elongate, subpyriform, highest at the anterior one-third the shell length, thickest somewhat posterior to the middle. Anterior end broadly and evenly rounded, passing in a smooth curve into the dorsal and ven-

tral margins. Posterior end narrowly rounded, with the greatest length of the valve at about the mid-point of the height. Dorsal margin nearly straight along the hinge line, and sloping toward the posterior. Ventral margin nearly straight and horizontal in its anterior half, then becoming strongly convex, and rising rapidly in an even curve to join the posterior margin. Surface of the valves closely covered with very minute, fairly deep pits, which become less pronounced toward the periphery. Several very slightly raised curvilinear ridges, near and subparallel to the ventral margin are often distinguishable, with the pits aligned in rows between them. Hinge line very slender and delicate; in the right valve with elongate, slightly raised, very faintly notched terminal dental areas. A faintly incised groove between the dentitions is most pronounced at its anterior end. Elongate, weakly developed, slightly notched terminal sockets at the cardinal angles of the left valve are joined by an elevated bar, which is most conspicuous on its anterior end, and which is separated from the dorsal margin by a faintly incised line. Marginal areas narrow, carrying a moderate number of fairly straight radial pore canals. Muscle-scar pattern indeterminate.

Length (right valve) 0.45 mm.; height 0.27 mm.

Occurrence.—The species is very rare in the Chipola formation of the Florida Miocene. I have observed it at a single station, Loc. 7, from which the figured specimens were obtained.

Types.—Syntypes, H. V. Howe coll., nos. 1552, 1553.

LOCALITIES

Loc. 1.—Caloosahatchee marl, Pliocene, exposed on the left bank of the Caloosahatchee River, at Ayer's Landing, 5 miles down river from La Belle, Hendry County, Fla. Collected by the late Karl E. Young. (This locality previously described as Sta. 18, Fla. Geol. Survey, Bull. 6, p. 10, 1931.)

Loc. 2.—*Arca* zone of the Choctawhatchee formation, Miocene, at small spring head in E. Gomillion's field, at Red Bay, Walton County, Fla. Collected by H. V. Howe and M. C. Israelsky. (U. S. Geol. Survey, loc. nos. 1/673 and 1/950; Sta. 41, Fla. Geol. Survey, Bull. 9, 1932, and Bull. 13, 1935.)

Loc. 3.—Shoal River formation, Miocene, toward upper end of Shell Bluff on right bank of Shoal River, 5 miles north of Mossyhead Walton County, Fla. Collected by H. V. Howe and M. B. Stephenson. (U. S. Geol. Survey, loc. no. 10658; Sta. 31, Fla. Geol. Survey, Bull. 9, 1932, and Bull. 13, 1935.)

Loc. 4.—Shoal River formation, Miocene, in small gully, 50 feet south of road and 150 feet east of bridge over White's Creek on Eucheeanna-Knox Hill road, 1 mile west of Valley Church, Walton County, Fla. Collected by H. V. Howe and M. C. Israelsky. (U. S. Geol. Survey, loc. no. 10608; Sta. 28, Fla. Geol. Survey, Bull. 9, 1932, and Bull. 13, 1935.)

Loc. 5.—Oak Grove formation, Miocene, at old saw-mill near Oak Grove on right bank of Yellow River, about 100 yards below bridge on Laurel-Oak Grove road, Okaloosa County, Fla. Collected by H. V. Howe and M. C. Israelsky. (U. S. Geol. Survey, loc. no. 7054; Sta. 26, Fla. Geol. Survey, Bull. 9, 1932, and Bull. 13, 1935.)

Loc. 6.—Oak Grove formation, Miocene, at Senterfiet's or Tanner's Mill (abandoned), 4 miles southwest of Laurel Hill, Okaloosa County, Fla. Collected by H. V. Howe and M. C. Israelsky. (U. S. Geol. Survey, loc. no. 10659; Sta. 29, Fla. Geol. Survey, Bull. 9, 1932, and Bull. 13, 1935.)

Loc. 7.—Chipola formation, Miocene, on Tenmile Creek, from bridge to one-half mile below bridge on the Marianna-Clarksville road, 22 miles south of Marianna, Calhoun County, Fla. Collected by Karl E. Young. (Sta. 10, Fla. Geol. Survey, Bull. 9, 1932, and Bull. 13, 1935.)

Loc. 8.—*Potamides matsoni* zone, from a 50 foot well in sec. 28, T. 3 N., R. 2 W., Rapides Parish, La. This is the type locality of the zone. Collected by Frank Lewis. (Previously described as the one locality from which microfossils were described in Louisiana Dept. Cons., Geol. Bull. 6, p. 187, 1935.)

REFERENCES

ALEXANDER, C. I., and C. W., *1933*, Reversal of valve size and hinge structure in a species of the genus *Cytheridea: Am. Midland Naturalist*, vol. 14, no. 3, pp. 280–283, text figs. 1–4.

BRADY, G. S., *1880*, Report on the Ostracoda dredged by H. M. S. *Challenger* during the years 1873–1876: *Challenger Reports, Zoology*, vol. 1, pt. 3, pp. 111, 112.

COLE, W. STORRS, *1931*, Pliocene and Pleistocene Foraminifera of Florida: *Florida Geol. Survey, Bull.* 6.

COOKE, C. WYTHE, and MOSSOM, STUART, *1929*, Geology of Florida: *Florida Geol. Survey, 20th Ann. Rept.*, pp. 98–149.

CUSHMAN, J. A., *1930*, Foraminifera of the Choctawhatchee formation of Florida: *Florida Geol. Survey, Bull.* 4.

———, and PONTON, GERALD M., *1932*, Foraminifera of the upper, middle, and part of the lower Miocene of Florida: *Florida Geol. Survey, Bull.* 9.

HOWE, H. V., and graduate students of Louisiana State University, *1935*, Ostracoda of the *Arca* zone of the Choctawhatchee Miocene of Florida: *Florida Dept. Cons., Geol. Bull.* 13.

———, and HOUGH, LEO, *1935*, Ostracoda of the *Arca* zone of the Choctawhatchee Miocene of Florida: *Florida Dept. Cons., Geol. Bull.* 13, pp. 10, 11, pl. 2, figs. 15, 16, 18; pl. 4, figs. 6, 10.

———, and MCGUIRT, JAMES H., *1936*, Salt domes of Plaquemines and St. Bernard Parishes: *Louisiana Dept. Cons., Geol. Bull.* 8, p. 234.

———, and STEPHENSON, M. B., *1935*, Ostracoda of the *Arca* zone of the Choctawhatchee Miocene of Florida: *Florida Dept. Cons., Geol. Bull.* 13, p. 10.

———, *1935a*, Louisiana Jackson Eocene Ostracoda: *Louisiana Dept. Cons., Geol. Bull.* 5, p. 16, pl. 1, fig. 11; pl. 2, figs. 13–15.

STEPHENSON, M. B., *1935*, Some microfossils of the *Potamides matsoni* zone of Louisiana: *Louisiana Dept. Cons., Geol. Bull.* 6, pp. 187–196, pl. 5.

———, *1936*, Shell structure of the ostracode genus *Cytheridea: Jour. Paleontology*, vol. 10, pp. 695–703.

———, *1936a*, Louisiana Vicksburg Ostracoda: *Louisiana Dept. Cons., Geol. Bull.* 7, p. 32, pl. 2, fig. 17; pl. 3, figs. 16, 17.

———, *1937*, Middle Tertiary Ostracoda of the genus *Cytheridea: Jour. Paleontology*, vol. 11, pp. 145–159.

ULRICH, E. O., and BASSLER, R. S., *1904*, *Maryland Geol. Survey, Miocene Rept.*, pp. 124–126, pl. 37.

MORTON B. STEPHENSON, LOUISIANA STATE UNIVERSITY, BATON ROUGE, LOUISIANA. PRESENT ADDRESS: BOX 1990, FORT WORTH, TEXAS. MANUSCRIPT RECEIVED BY THE EDITOR, NOVEMBER 23, 1937.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 149–155, PL. 25, TEXT FIGS. 1, 2,
MARCH, 1938

ATURIAS FROM THE TERTIARY OF MEXICO

A. K. MILLER AND W. M. FURNISH

ABSTRACT

Several representatives of the cephalopod genus *Aturia* from the Eocene and the Oligocene of Nuevo Leon and Tamaulipas, Mexico, are described and illustrated. Also, the morphology and the phylogeny of the genus are discussed, and it is concluded that for the present, at least, the recognition of subgenera is not practicable.

The Tertiary cephalopod genus *Aturia* is world-wide in its distribution and it is known from all of the continents, including Australia. The genus has been recorded from a number of localities in North, Central, and South America, but in so far as we have been able to ascertain, no representatives of it have been described or illustrated from Mexico and only one occurrence of it there has so far been reported. Therefore, several specimens from five localities in the states of Nuevo Leon and Tamaulipas, northeastern Mexico, which were kindly sent to us for study by Miss Julia Gardner, seem to merit more than ordinary consideration. Furthermore, these specimens, though not very complete, elucidate certain morphological features of the genus, and from this point of view also they are worthy of study. The completion of this investigation has been made possible through financial assistance received from Mr. Frederick O. Thompson of Des Moines, Iowa, to whom we acknowledge our indebtedness.

Although stratigraphically the genus *Aturia* ranges from the Eocene (or uppermost Cretaceous) into the Pliocene, as noted by Olsson (1928), most of the numerous species that have been named "are very similar, and it is still a question, how many really distinct species should be recognized." In 1921, von Ihering (p. 76) proposed a subgeneric name *Sphenaturia* for some forms from southern South America, but as both Schenck (1931) and Spath (1927) have pointed out, von Ihering apparently had an erroneous concept of *Aturia aturi* (Basterot), the genotype of *Aturia* (which was originally described from the Miocene of St. Paul de Dax in southwestern France), and the differences between the subgenotype of *Sphenaturia* and *A. aturi* do not seem to be of more than specific value. More recently Stenzel (1935) has proposed to recognize three subgenera of *Aturia: Aturia* s. s., *Nilaturia*, and *Brazaturia*. *Aturia* s. s. is stated to differ from the other subgenera particularly in that its siphonal collars are large and its siphuncle is centrodorsan rather than subdorsan in position. Stenzel apparently relied largely on Foord's description of the siphuncle of *A. aturi;* however, illustrations of topotypes published by Edwards (1849) and particularly of a specimen from Turin published by Spath (1933) seem to indicate that the siphuncle is not centrodorsan but subdorsan as in *Nilaturia* and *Brazaturia*. Stenzel states that in *Nilaturia* the lateral lobes of the sutures are rounded and not very deep and the dorsal lobe is deep and wide, but it should be taken into consideration that both of these are primitive characters and apparently Stenzel was studying small specimens which might change somewhat as they completed their ontogenetic development.[1] During the past year we have pre-

[1] Since these statements were written, Dr. Stenzel has kindly loaned us for study the specimens on which *Nilaturia* was based, and they do not seem to us to differ materially from typical representatives of *Aturia*. However, they represent a rather primitive species of the genus.

pared detailed studies of numerous representatives of *Aturia* from South America and Africa, as well as North America, and although we have made a conscientious effort, we have not been able to use the proposed subgenera. It seems to us that whereas the question of the generic or subgeneric division of the forms that are now grouped together under the generic name *Aturia* is deserving of very careful consideration, it will have to be done with a great deal of caution, and certainly in order to complete the work satisfactorily much more material than has been available to us, including representatives of the subgenotypes, will have to be examined critically. Our studies have gone to show that the individuals undergo considerable change during ontogenetic development (see text fig. 1), and although we believe that we can recognize more or less of a phylogenetic series within the genus, all of the observable differences are gradational and can not be used satisfactorily to differentiate subgenera.

Both ontogeny and chronology indicate clearly that *Aturia* developed from *Hercoglossa* through *Aturoidea*. *Hercoglossa* almost certainly arose from *Cimomia*. The progressive development of the sutures in this phylogenetic series is portrayed diagrammatically by text figure 1. It should perhaps be pointed out in this connection that the genus *Nautilus* s.s. is not an end-member of this series, but that it probably developed from some representative of either *Cimomia* or *Hercoglossa*.

In typical representatives of *Aturia* the first suture does not differ essentially from mature sutures of *Hercoglossa* (compare text figs. 1C and 1D). The sutures, however, develop rapidly during ontogenetic development and soon pass through an *Aturoidea* stage. In typical Eocene aturias, like those we are studying from Mexico, the sutures do not progress far beyond the *Aturoidea* stage, though the ventral lobe becomes flattened and the dorsal lobe becomes closed, that is, the two sides of the dorsal septal flexure become contiguous. In more advanced congeneric forms, which appear to range throughout most of the Tertiary, the umbilical portions of the sutures are modified by the introduction near the umbilical seam of a small secondary lobe in the bottom of the umbilical lobe (see text fig. 1G)—this secondary lobe is the result of the dorsolateral portions of the septa becoming attenuate. A great deal of significance has been attached to the shape of the lateral lobes of the sutures and it is undoubtedly of considerable importance. However, it is readily affected by preservation and interpretation.

In *Aturoidea* the camerae are moderately long and the siphuncle is well removed from the dorsal margin of the conch. However, in *Aturia* the camerae become relatively short at maturity and the siphuncle assumes a subdorsan position. In progressive representatives of *Aturia* the camerae are so short that the lateral lobes of adjacent sutures are in contact for a considerable portion of their length. In all members of the phylogenetic series under consideration, *Cimomia* to *Aturia*, inclusive, the growth-lines indicate that the aperture bears a broad

FIG. 1.—Diagrammatic representations of sutures of: *A*, A typical *Cimomia*, *C. vincenti* Miller, from the "Paleocene" of Landana, Kabinda, ×0.6; based on the holotype. *B*, A primitive *Hercoglossa*, *H. harrisi* Miller and Thompson, from the lower Eocene of Trinidad, ×0.75, based on syntypes. *C*, An advanced *Hercoglossa*, *H. orbiculata* (Tuomey), the genotype, from the lower Eocene of Alabama, ×0.25, based on the neotype. *D*, The first suture of a typical *Aturia*, undescribed species, from the Eocene of Angola, ×30, based on a syntype. *E*, A typical *Aturoidea*, *A. paucifex* (Cope), from the lower Eocene of New Jersey, ×0.75, based on the holotype. *F*, A typical Eocene *Aturia*, *A. alabamensis* (Morton), from the upper Eocene of Nuevo Leon, Mexico, ×3, based on the specimen represented by plate *25*, figs. 1 and 2. *G*, A more advanced *Aturia*, *A. curvilineata* Miller and Thompson, from the Miocene of Venezuela, ×0.6, based on the holotype.

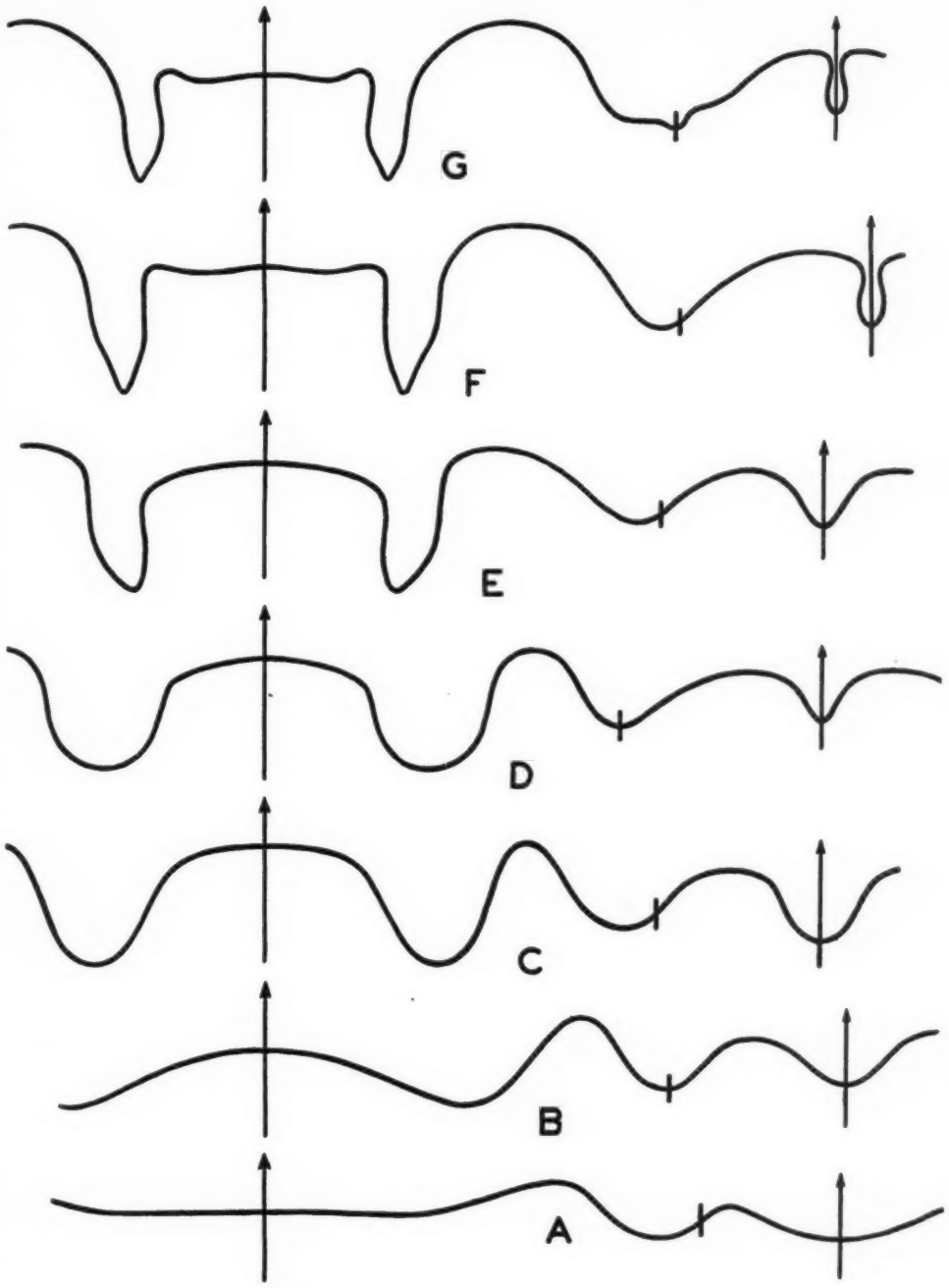


FIG. 1.—*(See opposite page for explanation)*

rounded ventral or hyponomic sinus but no lateral sinuses. Within this series, also, we recognize that there is a progressive tendency toward lateral compression of the conch and toward smaller and shallower umbilici. However, it should be pointed out in this connection that most of the numerous Tertiary nautiloids that we have had opportunity to study are considerably distorted, and therefore the prevalent tendency to use slight variations in the shape of the conch as specific characters is likely to lead to confusion.

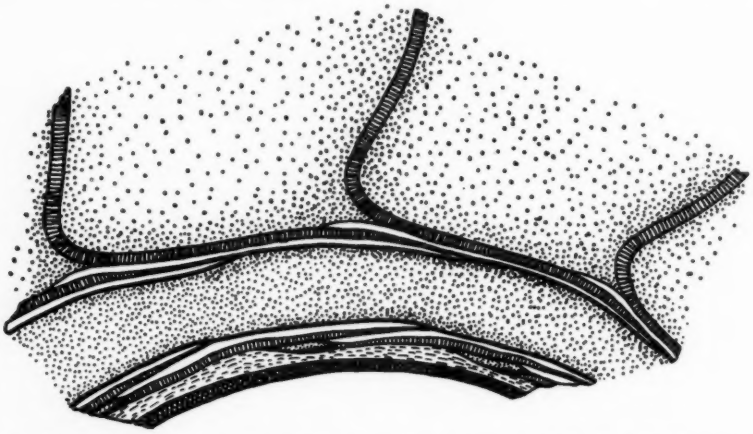


FIG. 2.—Median longitudinal section, ×3, of part of a mature volution of the phragmacone of *Aturia peruviana* Olsson from the upper Eocene near Sta. Rita, Lara, Venezuela, showing the structure of the siphuncle. This diagrammatic drawing, which is based on a thin-section in the Museum of Natural History at Basel, Switzerland, shows clearly the two layers of the dorsal wall of the conch and the long septal necks and connecting rings of the siphuncle. The outer layer of the dorsal wall of the conch is cross-hatched, whereas the inner is marked with dashed lines; the septa and the septal necks are marked with cross lines; the connecting rings are clear; the innermost layer or lining of the siphuncle is solid black; and the calcareous fillings of the camerae and the siphuncle, which were introduced during fossilization, are stippled. The small sublenticular stippled areas immediately adjacent to the dorsal wall of the conch are visible in only median sections. They represent the incompletely closed subdorsan portions of the dorsal flexures of the septa; this same incomplete closure causes the dorsal lobe of the sutures to be spatulate rather than linear.

Furthermore, part of the observable differences in the dimensions of the conch may of course be due to sexual dimorphism.

There has been much difference of opinion as to the structure of the siphuncle in *Aturia*. However, in all the numerous representatives of this genus that we have examined, the siphuncle is moderate in size, subdorsan (that is, marginal) in position, orthochoanitic in structure, and located in an infundibuliform dorsal adapical flexure of the septa—we should regard the septal necks as adapical extensions of this infundibular flexure, rather than regard the fairly large adoral part of this flexure, into which the siphuncle proper seems to invaginate, as part of the septal necks. This relationship of the septal necks to the dorsal flexure of the septa becomes clear when comparisons are made with *Aturoidea* in which the subdorsan position of the siphuncle in the dorsal flexure of the septa is anticipated. The thin-section represented by text figure 2 shows a median longitudinal section of the siphuncle in a mature conch, and it elucidates the details of the structure of the siphuncle much better than any congeneric specimen we have studied and appears to be

typical of the genus. Both the septal necks and the connecting rings are about 1.5 times as long as the camerae, but they overlap for about one-third of their length so that, combined, they are only about 2.5 times as long as the camerae. The adapical portion of each septal neck invaginates into the adoral portion of the adjacent connecting ring, and the connecting ring in turn invaginates into the next septal neck apicad. Although the septal necks are considerably longer than the camerae, adjacent septal necks are not in contact (as they are in the holochoanites) for they are separated from one another by the connecting rings. On the inside of the siphuncle there is a continuous thin lamellar deposit or layer which is essentially cylindrical in form and covers over septal necks and connecting rings alike; we have never observed a homologous deposit in any of the numerous nautiloids that we have sectioned, and in so far as we are aware, no morphological term has been coined for this lining of the siphuncle, although apparently it has been observed previously. We are not entirely certain about the structures shown in the extreme dorsal portion of the thin-section under consideration, but it appears that the dorsal wall of the conch is composed of two layers, the outer (dorsal) one of which is regular in thickness, whereas the inner one is thick along the adoral portions of the camerae but relatively thin along the adapical portions. The septal necks appear to be cemented to the thicker portions of this inner layer of the test throughout the entire length of these portions, and thin adoral continuations of the septal necks (which should probably be regarded as dorsal portions of the septa) extend orad for about half the length of the thinner portions of the inner layers of the test and are cemented to it. The siphuncle is then in direct contact with the dorsal wall of the conch along the thicker portions of the inner layer of that wall, and along the thinner portions it is only slightly removed from it. Both of the layers of the test, as well as the septal necks and the connecting rings, are lamellar in structure in the thin-section under consideration.

SYSTEMATIC DESCRIPTIONS

Genus ATURIA Bronn

ATURIA ALABAMENSIS (Morton)

Plate 25, figures 1, 2, 5, 6

Stenzel (1935) has recently described this species in detail and listed its complete synonymy. Since his report is readily available to most paleontologists, it will perhaps suffice here for us merely to describe and illustrate the Mexican specimens that we are studying.

One of the specimens that we refer to this species (pl. 25, figs. 1, 2), though rather small, is fairly well preserved, and it elucidates many of the significant characters of the species. The preserved portion of it, an internal mold of part of the phragmacone, attains a maximum diameter, measured across the umbilicus, of about 50 mm. and a maximum height and width of conch of about 30 mm. and 23 mm., respectively. The lateral zones of the conch, which converge ventrad, are flattened; the ventral zone is rounded; and the dorsal zone is deeply impressed by the preceding volution. The umbilicus is closed, small, and inconspicuous, and the umbilical shoulders are indefinite. No trace of the surface markings of the test is preserved. There are about 12 camerae in the outer volution of this specimen. Each suture forms a large straight-sided flattened ventral saddle, and on either side of it a deep narrow asymmetrically pointed lateral lobe, a large broad broadly rounded lateral saddle, a rounded lobe on the umbilical portions of the conch, and a rounded internal lateral saddle which extends to the closed spatulate dorsal lobe (see text fig. 1F). The deep lateral

lobes of the sutures extend apicad far enough to touch (or nearly so) the preceding suture. The siphuncle is subdorsan in position, and presumably its structure does not differ materially from that of *A. peruviana*, described in detail above.

The second specimen from Mexico that we are referring to this species is poorly preserved and we are uncertain in regard to its specific affinities. However, in so far as we have been able to ascertain, it does not differ essentially from the specimen described above, and it came from beds of about the same age. It is silicified throughout, and retains a replacement of the test. The preserved portion of it, which represents only part of the phragmacone, attains a maximum diameter, measured across the umbilicus, of about 100 mm. and a maximum height and width of conch of about 60 mm. and 40 mm. (estimated), respectively. Fragments of an outer volution of the conch which adhere to this specimen show that the phragmacone was at least one more volution in extent and that the conch attained a diameter of at least 200 or 300 mm. Traces of the growth-lines indicate that the aperture was marked ventrally by a deep rounded hyponomic sinus and laterally by a broad rounded salient which extended clear to the umbilicus. Umbilicus closed, small, and inconspicuous, and umbilical shoulders indefinite. Apparently the sutures and the siphuncle are similar to those of the specimen described above.

Remarks.—The large silicified specimen, discussed above, was examined by Stenzel (1935, p. 557), who recognized its affinities with *A. alabamensis*.

Occurrence.—The smaller of the specimens under consideration came from beds of Jackson (upper Eocene) age, near Rancho La Capa, Zacate Hacienda, Nuevo Leon, Mexico. The larger specimen came from clays in the so-called Fayette formation "carrying basal Jackson forams," about 5 km. south of El Azucar, Camargo district, Tamaulipas, Mexico. According to Stenzel (1935) this species occurs in the United States in the Castle Hayne marl of North Carolina, the Ocala limestone of Florida and Alabama, the "*Zeuglodon* beds" of Alabama, and the Moodys marl of Mississippi, all of which belong in the upper Eocene Jackson group.

Types.—Both of the hypotypes described above are to be deposited in the U. S. National Museum.

Aturia spp.
Plate 25, figures 3, 4, 7

The collections under consideration contain, in addition to the forms described above, three aturias from three different horizons and localities in the Lower Tertiary of Mexico, but unfortunately all of them are so incomplete and poorly preserved that their specific affinities can not be determined. We discuss them here largely to call attention to their occurrence at these localities, and also in the hope that we may stimulate workers in northeastern Mexico to look for more and better preserved specimens.

One of these specimens came from the lower Eocene, 3 miles south-southeast of Agua Leguas, near the Loma Camales airplane station, in Nuevo Leon. It is so poorly preserved and incomplete that we

---

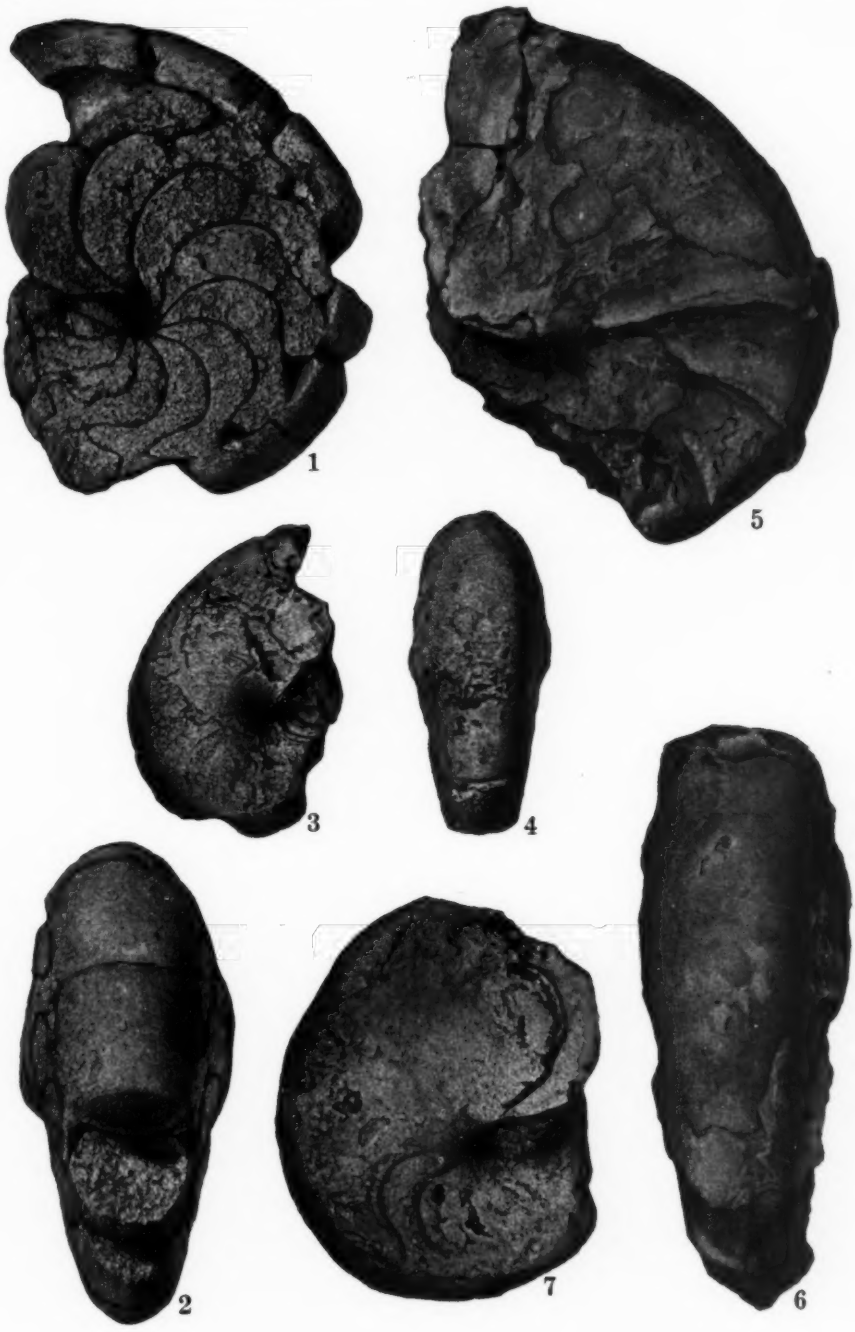
Explanation of Plate 25

Figs. *1, 2*—*Aturia alabamensis* (Morton). Lateral and ventral views, ×1.5, of an internal mold of part of the phragmacone, from the upper Eocene (Jackson) of Nuevo Leon. (p. 153)

3, 4—*Aturia* sp. Two views, ×1.5, of a small specimen from the lower Oligocene of northeastern Mexico. (p. 154)

5, 6—*Aturia alabamensis* (Morton)? Lateral and ventral views, ×0.75, of a fairly large specimen to which the dorsal wall of an outer volution of the phragmacone adheres, from the upper Eocene (Jackson) of Tamaulipas. (p. 153)

7—*Aturia* sp. Lateral view, ×1, of a septate specimen from the Mount Selman formation of Nuevo Leon. (p. 154)



Miller and Furnish, Tertiary Cephalopods

UNIV. OF MICH.

can not get a satisfactory photograph of it. The preserved portion of this specimen, which is septate throughout, apparently attained a maximum diameter of at least 60 mm. The shape of the sutures, of which all but the external lateral portions can be ascertained, indicate that the affinities of the specimen are with the genus *Aturia*.

A second specimen (pl. 25, fig. 7) came from about 60 to 100 feet above the base of the Mount Selman formation, 7 km. southwest of Estacion Aldamas, Nuevo Leon. This specimen also is septate throughout, and the preserved part of it attains a maximum diameter, measured across the umbilicus, of some 55 mm. and a maximum height and width of conch of some 35 mm. and 25 mm., respectively. The umbilicus is small, closed, and rather inconspicuous, and the umbilical shoulders are indistinct. The sutures and the siphuncle of this specimen, which are moderately well preserved, appear to be quite typical of the genus *Aturia*.

The third specimen under consideration (pl. 25, figs. 3, 4) came from the basal Oligocene at U. S. Geological Survey Sta. 13537, on the west slope of a high hill at the abandoned Topo ranch, 3,300 feet southwest of triangulation point Topo 2 in northeastern Mexico. This specimen, which represents only part of the phragmacone, is rather small, and its maximum diameter, measured across the umbilicus, is only about 28 mm. Near its adoral end its conch is about 17 mm. high and about 13 mm. wide. The umbilical portions of this specimen are not very well preserved, but apparently its umbilicus, growthlines, sutures, and siphuncle are quite similar to those of typical representatives of *Aturia*.

Figured specimens.—All three of the specimens discussed above are to be deposited in the U. S. National Museum.

REFERENCES

EDWARDS, F. E., *1849*, A monograph of the Eocene Mollusca, or descriptions of shells from the older Tertiaries of England, part I, Cephalopoda: *Palaeontographical Soc.*, vol. 2, pp. 1–56, pls. 1–9.

IHERING, H. VON, *1921*, Nautílidos del Terciario de Chile y de la Argentina (nota preliminar). *Physis. Soc. Argentina Cien. Nat., Revista*, tomo 5, no. 19, p. 76.

———, *1923*, Los Nautílidos del Terciario Patagónico y Chileno: *Mus. nac. hist. nat. de Buenos Aires, annales*, tomo 31, pp. 470–474, 1 pl.

MILLER, A. K., *1937*, Cephalopods from the Luculo Eocene: *Portuguese Geol. Survey, Bull.* (in press).

MILLER, A. K., and THOMPSON, M. L., *1937*, Some Tertiary nautiloids from Venezuela and Trinidad: *Eclogae geol. Helvetiae*, vol. 30, pp. 59–73, pls. 7–10.

OLSSON, A. A., *1928*, Contributions to the Tertiary paleontology of northern Peru, Part I, Eocene Mollusca and Brachiopoda: *Bull. Am. Paleontology*, vol. 14, pp. 47–200, pls. 6–31.

SCHENCK, H. G., *1931*, Cephalopods of the genus *Aturia* from western North America: *California Univ., Dept. Geol. Sci., Bull.*, vol. 19, pp. 435–491, pls. 66–78.

SPATH, L. F., *1927*, Revision of the Jurassic cephalopod fauna of Kachh (Cutch): *India Geol. Survey, Mem., Pal. Indica*, new ser., vol. 9, no. 2, pp. 19–26.

———, *1933*, The evolution of the Cephalopoda: *Biol. Reviews*, vol. 8, pp. 418–462.

STENZEL, H. B., *1935*, Nautiloids of the genus *Aturia* from the Eocene of Texas and Alabama: *Jour. Paleontology*, vol. 9, pp. 551–562, pls. 63, 64.

A. K. MILLER AND W. M. FURNISH, STATE UNIVERSITY OF IOWA, IOWA CITY, IOWA. MANUSCRIPT RECEIVED BY THE EDITOR, APRIL 21, 1937.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 156–166, PL. 26, TEXT FIG. 1, MARCH, 1938

THE CONODONT GENUS *ICRIODUS* AND ITS STRATIGRAPHIC DISTRIBUTION

E. B. BRANSON AND M. G. MEHL

ABSTRACT

The Devonian conodont genus *Icriodus* is redefined and its origin and relationships discussed. Nine species of the genus are figured, six of which are described as new. The stratigraphic and geographic range of the species is discussed and the evidence afforded by these conodonts for the correlation of several formations of questioned age is indicated.

In the course of detailed mapping in central Missouri much difficulty has been encountered in distinguishing the Callaway and Mineola limestones where the exposures are small and only one formation is present. Branson (1924, p. 18) has described the relationship between these two formations as follows:

> The Mineola is overlain by the Callaway limestone, Sylamore (Bushburg) sandstone, and Chouteau limestone, though the Chouteau is the commonest overlying formation. The disconformity between the Mineola and Callaway is much less distinct than between the Cooper and Callaway and the final determination of unconformity rests on the thickening and thinning of the Mineola and the overlap of the Callaway.

Although there is a markedly irregular contact between the Mineola and Callaway in some places, this contact is not widely exposed and is not evident in most of the outcrops. The Callaway, although generally highly fossiliferous, is not uniformly so, and the Mineola, with a fauna of 50 or more species, is in many places devoid of determinable remains. To add to the difficulty of its identification, the Mineola is very irregular in distribution. Within the general area of its occurrence it is absent in many places and in few localities does it have unbroken continuity of more than a few square miles. The lithology is more confusing than helpful. While the appearance of the Mineola as a whole is in sharp contrast with that of the Callaway, some of the

	WYOMING	OKLAHOMA	ARKANSAS	MISSOURI	IOWA	ILLINOIS	INDIANA	OHIO	MICHIGAN	NEW YORK	ONTARIO
UPPER DEVONIAN	DARBY I. SP. UNDET.	WOODFORD I. SYMMETRICUS ?	SYLAMORE I. SYMMETRICUS	LOUISIANA I. NODOSUS GRASSY CREEK I. CURVATUS I. ALTERNATUS I. SYMMETRICUS SNYDER CREEK I. EXPANSUS I. ALTERNATUS I. CYMBIFORMIS	GRASSY CREEK SWEETLAND CK. I. CURVATUS I. NODOSUS	GRASSY CREEK I. CURVATUS I. SYMMETRICUS	NEW ALBANY I. NODOSUS	HURON I. SYMMETRICUS ?		GENUNDEWA I. EXPANSUS I. NODOSUS I. LATERICRESCENS ? GENESEE	
MIDDLE DEVONIAN				CALLAWAY I. CYMBIFORMIS MINEOLA I. LATERICRESCENS I. EXPANSUS			JEFFERSONVILLE I. LATERICRESCENS	SILICA I. LATERICRESCENS I. EXPANSUS I. POSTIFLEXUS	ALPENA I. EXPANSUS FERRON I. LATERICRESCENS I. EXPANSUS		
LOWER DEVONIAN	DISTRIBUTION OF ICRIODUS IN THE DEVONIAN										

sandy phases of the lower Callaway duplicate the appearance of some of the phases of the Mineola.

As a possible aid in the mapping of the Mineola, an attempt was made to utilize conodonts and they have proved remarkably valuable. As is to be expected of dominantly limestone formations, neither the Callaway nor the Mineola has produced conodonts in abundance. However, some conodonts have been found in nearly every Mineola locality and the assemblages are distinctive.

The most abundant, and in some cases the only conodonts found, are to be referred to the genus *Icriodus*. This fact led to a study of all of the species of the genus and some of the results are presented in the following paragraphs.

STRATIGRAPHY OF *ICRIODUS*-BEARING FORMATIONS

The correlation table (fig. 1) lists the Sylamore of Arkansas as Devonian. The conodont genera *Icriodus*, *Palmatolepis*, *Ancyrognathus*, *Polylophodonta*, and *Ancyrodella*, hereafter referred to as the index Devonian genera, make up most of the fauna and none of these is known from unquestionable Mississippian formations. The basal Mississippian sandstones in eastern, central, and southwestern Missouri lack all of these genera and contain the conodont genera *Pseudopolygnathus*, *Siphonognathus*, *Pinacodus*, and *Solenognathus*, hereafter referred to as index Mississippian genera. These sandstones have been called Sylamore incorrectly and should be designated as Phelps or Bushburg.

There is a reversion to early classification in listing the Louisiana limestone in the Devonian. It has been called Mississippian by almost all who have studied it excepting the earliest investigators. However, Moore (1928), in his work on the early Mississippian of Missouri, did not accept it as unquestionable Mississipian. The Louisiana bears the index Devonian genera of conodonts and its invertebrate fauna is Devonian in aspect, lacking all productid genera excepting *Productella*.

The Grassy Creek shale has been referred to the Mississippian by many writers since Ulrich (1911) first placed it there. Its reference to the Devonian by us is based on the conodonts as discussed elsewhere (Branson and Mehl, 1933, p. 179).

The Woodford shale proper, south of Ada, Okla., contains typical Devonian genera, but the top few inches of reworked materials which separate the Woodford from overlying Welden beds bear the basal Mississippian group of conodonts.

The typical Devonian genera of conodonts have been found in the New Albany shale of Indiana, except in a thin zone at the top which is made up of the reworked residuum in an advancing early Mississippian sea. The writers sampled this reworked zone in two places and found typical Mississippian genera present. Huddle's paper (1934) on the New Albany conodonts lists many of the occurrences as upper New Albany, most of which are of typical basal Mississippian forms. Most of the other references, from lower in the New Albany, duplicate the occurrences in the Grassy Creek of Missouri. *Icriodus* has not been found in the upper member but occurs below this.

The Sweetland Creek of Iowa seems to be a phase of the Grassy Creek (Branson and Mehl, 1933, p. 180) and as the name Grassy Creek has priority, the Iowa phase may properly be called Grassy Creek.

The Genesee and Genundewah of North Evans, N. Y., contain typical Devonian conodont genera, including *Icriodus*, and many of the same species that are present in the New Albany, Grassy Creek, Woodford, Sylamore of Arkansas, and Hardin of Tennessee. The conodonts listed by Ulrich and Bassler (1926) from the Hardin are typical Devonian forms. In addition to these, the writers find *Icriodus* present, although it is rare.

A considerable collection of conodonts from a channel-fill in the Silurian near Elmhurst, Ill., was made available by C. C. Branson who investigated the locality from which Weller (1899) reported Devonian fishes. In this conodont assemblage *Icriodus* is conspicuous and many other typical Devonian genera are abundantly represented. The fish, *Ptyctodus calceolus*, found by Weller in the channel-fill, is common in the Grassy Creek shale and the Sylamore sandstone of Arkansas. It is also found in the basal Mississippian sandstones of Missouri, but there is strong evidence that the Mississippian specimens were derived from Devonian sediments.

The lower part of the Huron shale (lowermost Ohio shale in Ohio) contains typical Devonian conodont genera, but as all of the conodonts are on slabs, we have not found it possible to identify the *Icriodus* species.

The conodonts of the Darby of Wyoming indicate Upper Devonian age for the formation. The icriodids are fragmentary but serve to confirm the evidence of other conodonts. The conodonts were found near the top of the formation west of Bull Lake, about 40 miles northwest of Lander. The writers have found many bones of fishes in the Darby, but their investigations on the fishes are incomplete and the bones have not furnished positive evidence of the place of the formation in the Devonian.

DISTRIBUTION OF SPECIES

All of the species of *Icriodus* are fairly sharply defined excepting *I. nodosus*. Some specimens of this species approach the development of *I. curvatus* at one of the extremes and *I. expansus* at the other. The immature specimens of some of the more slender species, such as *I. symmetricus*, resemble somewhat the mature form of *I. cymbiformis*.

Species of *Icriodus* seem to be exceptionally good horizon markers in so far as the larger stratigraphic units are concerned. This is the result of the abundance of specimens, regardless of the nature of the sediments, and the widespread geographical occurrence of some species.

I. alternatus has been found only in a few localities of the Grassy Creek shale in northeastern Missouri, and in the Snyder Creek shale of central Missouri, but is nowhere abundant.

I. symmetricus is very abundant in Grassy Creek and Louisiana limestone localities and fairly common in the Sylamore of Arkansas. A form close to this, or identical, has been found in the Woodford beds of Oklahoma and the basal part of the Huron shale of Ohio. In the Huron and Woodford the specimens are on slabs, and, as is generally the case in slab materials, the identifications are uncertain.

I. expansus is common in the Mineola and rare in the Snyder Creek of Missouri. It is common in the Genundewah of New York.

I. curvatus seems to be confined to strata of very late Devonian age. It has been found in abundance from the Sweetland Creek at the type locality and other exposures in Iowa, from the Grassy Creek shale of a dug well near Bedford, Ill., and from a blue to black shale which outcrops in a small area near Boaz, in southwestern Missouri.

I. latericrescens is particularly significant in its distribution. It is the most abundant and in some samples the only conodont found in the Mineola limestone of central and northeastern Missouri, and it occurs in the Jeffersonville limestone at the Falls of the Ohio with a similar association.

Branson (1924, p. 24) concluded that the Mineola was of Middle Devonian age and equivalent, in part, to the Jeffersonville of Indiana. This opinion was based on the relationship between the Callaway and the Mineola and an analysis of some 50 invertebrate species of the Mineola.

The presence of *I. latericrescens* in both formations and its absence from younger formations, save the doubtful cases listed under the specific description, adds

to the evidence for correlating the Jeffersonville and the Mineola.

I. elevatus, although distinctive, is of little use in stratigraphic determinations. It occurs very sparingly in only one locality and is confined to the Mineola.

I. cymbiformis is fairly abundant in all Snyder Creek localities and some specimens have been found in the Callaway limestone. It is possible that Callaway occurrences of this species are in stratigraphic leaks, i.e., materials of the Snyder Creek that have filtered into solution bands along the bedding planes of the Callaway.

I. nodosus is common in the Genundewah limestone on Eighteen Mile Creek, N. Y., and a few specimens have been found in the New Albany of Indiana.

I. pastiflexus has been found only in the Silica shale at Sylvania, Ohio.

SYSTEMATIC DESCRIPTIONS

Genus ICRIODUS Branson and Mehl

Icriodus BRANSON and MEHL, *1933*, Missouri Univ. Studies, vol. 8, p. 225, (published in 1934). Genotype, *I. expansus* Branson and Mehl.

The original description, with italicized additions, follows:

> Platform-like teeth with high sides either straight or flaring near the lower margin, of more or less spindle-shaped or lachrymiform outline in superior view, *modified in some forms by a laterally projecting process at the posterior end*, and without a distinct anterior blade as in the polygnathids. The aboral side is deeply excavated its entire length and the oral surface consists of two or more longitudinal rows of low sharp cusps.

Icriodus is one of the most sharply defined and distinctive of the Devonian forms. It is one of the several genera that range through Upper Devonian strata but fail to appear in the Mississippian. Nothing in the faunas following the Devonian seems to have been derived from the icriodids.

The beginnings of the genus are somewhat conjectural, apparently falling in one of the major gaps in our present knowledge of conodont history, which include the Late Silurian and Early Devonian. As the genus is represented in some abundance and considerable variety in the Middle Devonian, a Lower Devonian or older origin is indicated.

The Ordovician genus *Scyphiodus* Stauffer (1935) resembles *Icriodus* in some of its gross features. The oral topography in both consists of three longitudinal rows of denticles, and the aboral side is longitudinally excavated through most, or all, of its length. However, the development of the oral surface in these and similar forms is not of major importance but is likely to include similar features which result from analogous functions. In the case of *Icriodus* and *Scyphiodus*, similarities or differences in denticulation features are apparently of no more than specific value. However, the differences in the mandible of these two genera, as indicated by the aboral attachment scar, seem to be of generic importance. In *Scyphiodus*, the mandible is very thin except for a lateral thickening at the posterior end. Although the base of the tooth is comparatively broad, judging from Stauffer's illustrations and description, it is more or less barlike without evidence of attachment other than completely within the aboral longitudinal groove. This groove, "beginning at anterior and expanding into a deep rounded concavity at posterior" is, nevertheless, comparatively narrow. In the icriodids the mandible thickens rapidly to a very marked lateral expansion at the posterior end. The thin lateral walls diverge or flare aborally so that the greatest width of any cross section of the tooth is at its base. The tooth is in no sense barlike, but is rather a sheath, clasping a comparatively thick ramus. Many specimens retain fragments of the mandible within the aboral cavity.

Icriodus seems to be derivative of the trend of which *Spathodus* is typical. An undescribed species of *Spathodus* from

the Middle Silurian, if slightly modified, might well be referred to the icriodids. The navel of this form is near the posterior end of the blade and on the oral side of this expansion are laterally arranged denticles on both the inner and outer sides of the blade. This development is similar to the single-winged *Icriodus* from the Middle Devonian, except that in the latter only the inner expansion is denticulate.

In our survey of all the conodont collections that have been available to us, we have found relatively few species of *Icriodus*, although almost every producing zone and locality of Middle and Upper Devonian age has yielded some specimens. Some samples have furnished a great abundance of well-preserved individuals.

ICRIODUS NODOSUS (Huddle)
Plate 26, figures 14–17, 22

Gondolella? nodosa HUDDLE, *1934*, Bull. Am. Paleontology, vol. 21, p. 94, pl. 8, figs. 24, 25.

Huddle's description, made from two imperfect specimens:

> Tooth small, consisting of a narrow base, a median carina, and a single row of nodes on each side of the carina. Carina with nodes and denticles more or less fused especially near the posterior end, and flanked by deep grooves; lateral nodes originate near the base of the tooth and rise as high as the carina, but posteriorly one or two of the denticles of the median carina extend behind the last lateral nodes. Aboral surface marked by a large, thin walled escutcheon situated at the posterior end, which expands wider than any other portion of the tooth and continues forward to the anterior end as a thin walled trough. Length of holotype, 0.7 mm.

Holotype.—Indiana Univ. Pal. Coll., no. 1940, lower New Albany shale.

Huddle refers the species doubtfully to *Gondolella* because of the lack of prominence of the median crest. We have studied the type and compared it with all of the other specimens of *Icriodus* in our collections. The specimen does not show all details of the aboral side. The added description is drawn from specimens taken from the Genundewah limestone of North Evans, N. Y., furnished by C. C. Branson.

Added description.—The sides, viewed aborally, diverge posteriorly fairly rapidly from the pointed anterior end to somewhat less than two-thirds the length of the tooth with but slight flare of the edge. The posterior third or more of the aboral outline is nearly semicircular but has an abrupt offset on the inner side. This offset is the main feature that distinguishes the species from *I. expansus*. The aboral side is deeply excavated from the anterior end to about the base of the second from the last median row denticle.

Remarks.—*Icriodus nodosus* is similar to the genotype, *I. expansus*, differing most in that its sides are subparallel, while the outline of *expansus* is that of a biconvex lens.

Hypotypes.—Univ. Missouri, no. C250–5, Genundewah limestone, North Evans, N. Y.

ICRIODUS EXPANSUS Branson and Mehl, n. sp.
Plate 26, figures 18–21

Average length about 0.8 mm.; somewhat less than four times as long as wide; outline of oral surface biconvex with sides gently and regularly curved to sharp anterior and posterior ends, the greatest width near mid-length; axis straight or very slightly incurved near the posterior end.

Denticulation consisting of three longitudinal rows, distinct throughout most of their length, but merging anteriorly so that the first three transverse units consist of one, two, and three denticles respectively, from the anterior end backward. The median series, exclusive of the anterior transverse units, consists of 8 to 10 discrete, round-tipped or slightly pointed denticles, all fairly uniform in size and circular in cross section, excepting the posterior one or two which are slightly larger than the others and in some specimens laterally compressed. The denticles of this row tend to rise slightly above those of the lateral series.

Each lateral row consists of about 7 to 9 discrete, transversely oval to elon-

gate elliptical blunt or slightly pointed denticles, which increase in diameter slightly toward mid-length of the series, in extreme variations nearly joining those of the middle row. The lateral rows fail to reach the posterior end by about two of the middle row denticles. Transversely the denticles of the three rows fail to align, but are not to be described as alternating, those of the lateral rows falling slightly behind their corresponding unit of the middle row.

The aboral side is deeply excavated from the anterior end to the base of the next to the last median posterior denticle. The sides of the anterior half flare slightly and diverge regularly backward forming a deep groove. The posterior half of the sides flares sharply, more abruptly on the inner side, so as to form a nearly circular outline interrupted in front by the deep groove formed by the anterior half of the sides.

Occurrence.—Mineola limestone and Snyder Creek shale, Callaway County, Mo.; Genundewah limestone, North Evans, N. Y.; Silica shale, Sylvania, Ohio; New Albany shale, Chelsa, Ind.; Sylamore sandstone, 11 miles east of Rogers, Ark.; Alpena limestone, Alpena, Mich.

Remarks.—*I. expansus* does not vary greatly within a formation, but there is a tendency toward progressive changes such that the most extreme variant in the Snyder Creek (Upper Devonian) differs constantly from the type. There is a tendency for the denticles of the lateral rows to become antero-posteriorly compressed so as to form, with the corresponding nodes of the median series, transverse three node ridges (fig. 21).

I. expansus has not been found in abundance in the Mineola, although it occurs sparingly in nearly all producing localities. Its presence in the Snyder Creek records a range from Middle Devonian well up in the Upper Devonian. It has not been found in the Callaway limestone, which lies unconformably on the Mineola and underlies the Snyder Creek. However, the Callaway has not been very productive of conodonts outside of many worn specimens derived from Middle Devonian rocks, presumably Mineola.

It is difficult to distinguish between legitimate conodont occurrences and admixtures in the Genundewah, because the major portion seems to be made up of specimens from older Devonian formations as indicated by actual identifications and by varying degrees of wear. The thin, widely flaring sides of *I. expansus* almost prohibit its occurrence as well-preserved specimens unless they are indigenous and many good specimens have been taken from the Genundewah.

Syntypes.—Univ. Missouri, no. C249–3, Mineola limestone near Big Springs, Montgomery County, Mo.

ICRIODUS SYMMETRICUS Branson and Mehl
Plate 26, figures 1–3

Icriodus symmetricus BRANSON and MEHL, *1934*, Missouri Univ. Studies, vol. 8, p. 226, pl. 13, figs. 1–3.

ICRIODUS ALTERNATUS Branson and Mehl
Plate 26, figures 4–6

Icriodus alternatus BRANSON and MEHL, *1934*, Missouri Univ Studies, vol. 8, pp. 225, 226, pl. 13, figs. 4–6.

ICRIODUS ELEVATUS Branson and Mehl, n. sp.
Plate 26, figures 7–9

A simple, somewhat blade-like form about one-half as high as long with length about 0.7 mm., approximately eight times as long as wide, and with axis slightly curved laterally. The denticulation consists of a single longitudinal row of about seven laterally compressed denticles of slightly irregular size, the larger toward the anterior end. The denticles project alternately to the right and left like teeth of a well-set saw. In lateral view by transmitted light the denticles appear to diverge somewhat fanlike, so as to exclude one or more from the oral edge. They are exceptionally long, but are fused from their origin to close to their apices, thus giving the tooth a height half as great as the length. The aboral side is deeply excavated from the pointed

anterior end to the base of the posterior denticle, with gradually diverging sides and little flare in the interior half. The posterior half flares to a broadly rounded posterior end with sharply offset inner margin.

Occurrence.—Mineola limestone, about 2 miles north of Big Springs, Montgomery County, Mo.

Remarks.—The species is represented by only one complete specimen. It lacks the median row of denticles characteristic of the genus, but this seems to have been suppressed by crowding together of the lateral rows thus giving an arrangement like saw teeth.

Holotype.—Univ. Missouri, no. C249–2.

ICRIODUS CURVATUS Branson and Mehl, n. sp.
Plate 26, figures 23–26

A slender form of less than average height, somewhat more than five times as long as wide with average length about 0.85 mm.; sides parallel in oral view except near the ends, axis regularly curved laterally.

Denticulation consisting of three longitudinal rows that are distinct throughout their length except close to the anterior end where the order, progressing from the anterior point, is one, two, and three. The median row consists of about 10 to 13 long sharp, discrete or anteroposteriorly connected denticles, circular in cross section or slightly compressed laterally, all except one or two at each

---

EXPLANATION OF PLATE 26

All specimens here figured are from formations of Middle or Upper Devonian age. Enlargements to 20 diameters unless otherwise stated.

FIGS. *1–3*—*Icriodus symmetricus* Branson and Mehl. Oral, aboral, and lateral views of three syntypes (Univ. Missouri, No. C243–1), from the Grassy Creek shale on Sees Creek, Monroe County, Mo. (p. 161)

4–6—*Icriodus alternatus* Branson and Mehl. Lateral, aboral, and oral views of three syntypes (Univ. Missouri, No. C220–3), from the Grassy Creek shale, about 7 miles north of Monroe City, Monroe County, Mo. (p. 161)

7–9—*Icriodus elevatus* Branson and Mehl, n. sp. Lateral, oral, and aboral views of holotype (Univ. Missouri, No. C249–2), from the Mineola limestone about 2 miles north of Big Springs, Montgomery County, Mo. (p. 161)

10–13—*Icriodus postiflexus* Branson and Mehl, n. sp. Oral, lateral, aboral, and oral views of three syntypes (Univ. Missouri, No. C438–1), from the Silica shale, near Sylvania, Ohio. Figs. *10* and *11* are of the same specimen. (p. 163)

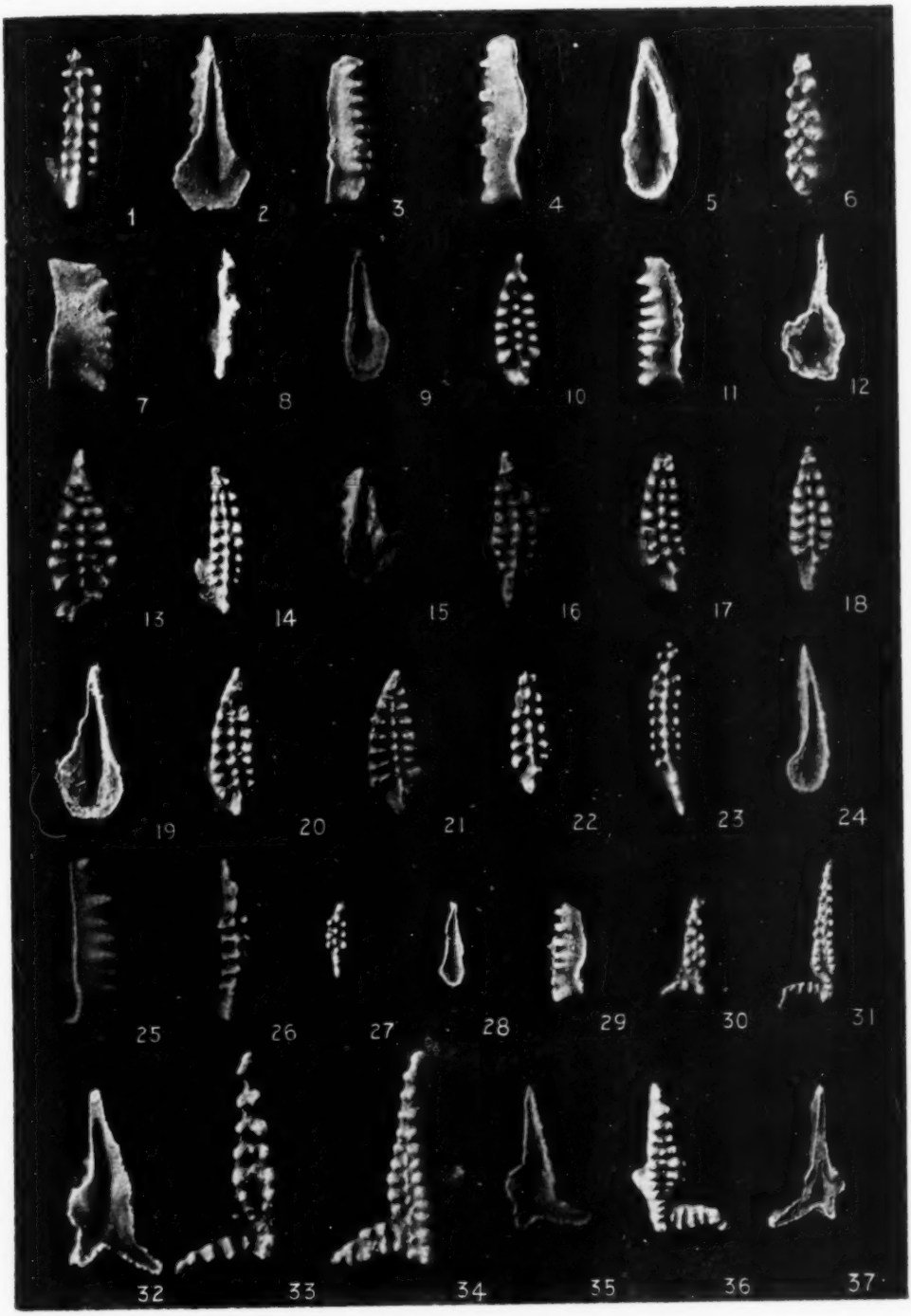
14–17, 22—*Icriodus nodosus* (Huddle). Four hypotypes (Univ. Missouri, No. C250–5), from the Genundewah limestone, North Evans, N. Y.; fig. *22*, oral view of the holotype (Indiana Univ., No. 1940) from the lower New Albany shale, Indiana. (p. 160)

18–21—*Icriodus expansus* Branson and Mehl, n. sp. *18, 19*, Oral and aboral views of two syntypes (Univ. Missouri, No. C249–3) from the Mineola limestone, about 2 miles north of Big Springs, Montgomery County, Mo. *20*, Oral view of specimen (Univ. Missouri, No. C257–1) from the Genundewah limestone, North Evans, N. Y. *21*, Oral view of specimen (Univ. Missouri, No. C250–4) from the Snyder Creek shale on Cow Creek, Callaway County, Mo. (p. 160)

23–26—*Icriodus curvatus* Branson and Mehl, n. sp. Oral, aboral, lateral, and oral views of four syntypes (Univ. Missouri, No. C250–3), from a Late Devonian shale east of Boaz on the James River, Greene County, Mo. (p. 162)

27–29—*Icriodus cymbiformis* Branson and Mehl, n. sp. Lateral, oral, and aboral views of three syntypes (Univ. Missouri, No. C197–1), from the Snyder Creek shale on Cow Creek, Callaway County, Mo. (p. 164)

30–37—*Icriodus latericrescens* Branson and Mehl, n. sp. *30, 32*, Oral and aboral views of two syntypes (Univ. Missouri, No. C250–2) from the Mineola near Big Springs, Montgomery County, Mo. *31*, Oral view of an exceptionally large specimen (Univ. Missouri, No. C249–4) from the Mineola at Belamy Springs, Callaway County, Mo. *33, 36, 37*, Oral views and aboral view of three specimens (Univ. Missouri, No. C250–1) from the Jeffersonville at the Falls of the Ohio, Ind. *34, 35*, Oral and aboral views of two specimens (Univ. Missouri, No. C249–1) from the Mineola about 2 miles north of Big Springs, Montgomery County, Mo. (p. 164)



Branson and Mehl, Devonian Conodonts

UNIV. OF MICH.

terminus of the tooth reaching the same level which is distinctly above that of the lateral rows. The anterior denticle of this series tends to point forward as much as up, and the posterior two or three, commonly somewhat larger than the others and more compressed laterally, tend to incline somewhat backward.

Each lateral row consists of about 6 to 10 sharp, pointed denticles of subequal size. The lateral denticles, which are aligned with those of the median row, tend to connect with the median series by low, but distinct, straight transverse ridges. Posteriorly, the lateral rows end abruptly at the third or fourth from the last denticle of the median row.

A deep aboral excavation separates the sides from a point somewhat back of the anterior end to about the base of the next to the last denticle of the median row. The sides diverge gradually in the anterior two-thirds with little flare, and more strongly with greater flare in the posterior third to give a semicircular outline to this part of the base, the flare chiefly on the inner side. The expanded part of the base is smaller than in most other species of the genus.

Occurrence.—Late Devonian shale on the James River, east of Boaz, Greene County, Mo.; Grassy Creek (Sweetland Creek) shale at the type locality of the Sweetland Creek, 4 miles east of Muscatine, Ia.; Grassy Creek from a well at Bedford, Ill.; Devonian channel fill in Niagaran dolomite near Elmhurst, Ill.

Remarks.—This species shows considerable variety, particularly in the length-width proportion which is not due to variation in the number of denticles. Some specimens with fewer denticles are actually broader than others with a greater number. The growth variations involve chiefly additions of denticles at the anterior end, a tendency for the development of transverse connecting ridges, and, in the case of median row denticles, the development of anteroposterior connecting ridge.

I. curvatus resembles most closely *I. nodosus* of the Genundewah limestone. However, the latter is broader, the denticles are fewer, the axis is very slightly curved if not straight, the posterior end of the median denticle row is less extended, and the posterior expansion of the aboral side is more pronounced.

Syntypes.—Univ. Missouri, no. C250–3, Upper Devonian near Boaz, Mo.

ICRIODUS POSTIFLEXUS Branson and Mehl, n. sp.
Plate 26, figures 10–13

A compact form with length-width ratio of the oral surface about 2:1 and average length about 0.7 mm. Outline of oral side regularly biconvex with posterior end rounded to lachrymiform, with greatest diameter near the posterior end; regularity of the posterior margin interrupted by the extension of one or two of the posterior denticles. Axis nearly straight excepting a slight inward curvature at the anterior end and a short but pronounced lateral flexure of the median row denticles at the posterior end.

There are about 6 or 8 denticles in each of the lateral rows and 7 to 10 in the median row. The anterior end is formed by a single denticle followed by a compound unit, the union of two lateral row denticles or rarely the union of these with a small median row denticle. Back of these first two units the denticles of the lateral rows are all discrete and separated from those of the median row which are also separated to their bases. Denticles of the median row are circular in cross section, those of the lateral rows are considerably larger and transversely elongate. All the denticles reach the same plane and are somewhat longer than the average among icriodids. The posterior two or three denticles of the median row are more or less united to form an irregular and variable process that extends backward and outward.

The excavation of the aboral side is deep but very narrow in its anterior half with but little expansion posteriorly and very slightly flared margins. The excavation of the posterior half is abruptly

expanded into a large subcircular cup with flaring margins.

Occurrence.—Silica shale, Sylvania, Ohio.

Remarks.—This species varies considerably, not only with the age of the individual, but among specimens of the same stage of development. In some specimens the lateral denticles are nearly aligned with those of the median row and in others alternate in position. Apparently in old specimens additional small denticles are to be expected between the median and lateral rows, and in some such specimens some of the median row denticles may be connected by ridges with those of the lateral row.

Typical specimens of *I. postiflexus* differ from those of *I. expansus*, which they most closely resemble, in the greater length of the denticles, the conspicuous posterior flexure, and the narrow anterior half of the aboral excavation.

Syntypes.—Univ. Missouri, no. C438-1.

ICRIODUS CYMBIFORMIS Branson and Mehl, n. sp.
Plate 26, figures 27–29

A delicate form; low, small, with average length of about 0.4 mm. and oral surface about four times as long as wide; lateral edges straight and subparallel; axis straight or very slightly curved.

Denticulation consisting of three longitudinal rows that are distinct throughout their length. The median series consists of about 7 to 9 somewhat laterally compressed, moderately sharp-pointed, discrete denticles, the posterior two of which are more compressed, wider antero-posteriorly, and less sharply separated from each other than the others. The lateral rows consist of three or four sharply conical denticles, which are distinctly separated to their bases from the median row. The lateral row denticles alternate in position with those of the median row, the last of the lateral series rising from a point between the third and fourth from the posterior end of the median series. The apices of all of the denticles lie in a common plane.

Aboral side deeply excavated from the anterior end to the base of the posterior denticle, with sides gently flaring except toward the posterior end where they curve outward rapidly. Outline slenderly lachrymiform, nearly bilaterally symmetrical with posterior and posterolateral margins regularly rounded.

Occurrence.—Snyder Creek shale, Cow Creek, Callaway County, Mo.

Remarks.—In the distinctly alternate position of its lateral and median row denticles this species most nearly resembles the Grassy Creek species, *I. alternatus* Branson and Mehl, which is larger, has no laterally compressed denticles except in the median row, and has no extension of the median row beyond the lateral series. In its tendency toward slight lateral curvature and the marked extension of the median line behind the lateral row, *I. cymbiformis* resembles *I. curvatus*. In *I. curvatus* the denticles are much more numerous and laterally almost aligned, and there is a much wider flare of the inner posterior side of the aboral outline.

I. cymbiformis is very abundant in nearly every Snyder Creek locality and zone, but has been identified from no other formations, excepting the Callaway limestone where it is rare. It is not unlike the immature form of several later species, but these are always associated with much larger specimens linked by intermediate gradations from immature to adult and offer little chance of confusion when not found as isolated specimens.

Syntypes.—Univ. Missouri, no. C197-1.

ICRIODUS LATERICRESCENS Branson and Mehl, n. sp.
Plate 26, figures 30–37

A highly modified form of complicated outline. Exceptionally long with average length of adult specimens slightly more than 1 mm. and maximum length about 1.5 mm. The outline of the oral surface is gently biconvex, pointed at both ends, the greatest width, about one-fifth the length, slightly back of mid-length, the

axis straight. A postero-lateral spur of about half the length of the tooth extends outward from the posterior end at an angle of approximately 90 degrees and the axis curves slightly backward toward its terminus.

The denticulation of the platform consists of three longitudinal rows which merge anteriorly into two and terminate as one. The median row is aberrant, with about five laterally compressed denticles, alternating in position with those of the lateral rows, prominent in young forms to weak in mature forms and in some old specimens almost obsolete. Outer lateral row consisting of about 7 rounded, discrete, subequal denticles. Inner lateral row consisting of about 10 rounded denticles, the posterior one to three of which are larger than the others and tend toward a transverse ridge-like form. This row extends posteriorly beyond the inner row and reaches the posterior margin of the platform. All denticles of the lateral rows reach a common level somewhat above the denticles of the median row. The postero-lateral spur bears two longitudinal (transverse to the axis of the platform proper) rows, each composed of about four low rounded, denticles, with one similar denticle at the terminus. These denticles rise to nearly the same plane as those of the platform.

The entire aboral side, including the full length of the postero-lateral spur, is deeply excavated, with the sides gently flaring. The longitudinal excavation forms an oblique cross with that of the spur, the long end of this cross excavation inclined backward and the short end projecting slightly beyond the otherwise regular inner side of the platform excavation. The outline resembles somewhat that of a boot pinched to a point at the top, with a pointed heel, and a stong flare just above the heel.

Occurrence.—Mineola limestone, east-central Missouri; Jeffersonville limestone at the Falls of the Ohio; Silica shale, Sylvania, Ohio; one broken specimen from the Ferron shale near Bell, Mich.; four broken and worn specimens, doubtfully referred, from a collection of hundreds of other icriodids from the Genundewah of New York. Many Genundewah conodont specimens clearly represent reworked residuum of an earlier Devonian formation, and although these specimens do not show marked abrasion it is scarcely safe to record them as legitimate records of the species.

Remarks.—This is probably the most distinctive of the icriodid species and one of the most variable. In size it ranges from 0.4 mm. to 1.5 mm. long, depending apparently on the age of the individual. In immature specimens the denticles of the platform are sharply outlined and all of about the same size. If not modified by the postero-lateral spur, the teeth would appear much like adults of *I. cymbiformis*. As the teeth increase in size the denticles of the lateral rows become larger, more blunt, and transversely ridge-like, and the denticles of the median row tend toward complete suppression. Lengthening of the platform comes chiefly through additions of denticles at the anterior end. The postero-lateral spur, little more than a short blade in immature forms, increases in length and width with age and adds denticles, first as a single row and then two. The denticulation of this process is more irregular at all stages of development than that of the platform proper.

There is little evidence for the arrangement of this type of tooth in the mouth, but for convenience of description the slender end is designated as anterior, as in the other icriodids, and the postero-lateral process is assumed to be directed outward.

Syntypes.—Univ. Missouri, no. C249-1, from the Mineola about 2 miles north of Big Springs, Montgomery County, Mo.

REFERENCES

BRANSON, E. B., *1924*, The Devonian of Missouri: *Missouri Bur. Geology and Mines*, 2d ser., vol. 17, 279 pp., 10 figs., 79 pls.

BRANSON, E. B., and MEHL, M. G., *1933*, Conodonts from the Grassy Creek shale of Missouri: *Missouri Univ. Studies*, vol. 8, no. 3, pp. 171–259.

HUDDLE, JOHN W., *1934*, Conodonts from the New Albany shale of Indiana: *Bull. Am. Paleontology*, vol. 21, no. 72.

MOORE, RAYMOND C., *1928*, Early Mississippian formations in Missouri: *Missouri Bur. Geology and Mines*, 2d ser., vol. 21, pp. 34–37.

STAUFFER, CLINTON R., *1935*, The conodont fauna of the Decorah shale (Ordovician): *Jour. Paleontology*, vol. 9, pp. 596–620.

ULRICH, E. O., *1911*, Revision of the Paleozoic systems: *Geol. Soc. America, Bull.*, vol. 22, p. 608.

ULRICH, E. O., and BASSLER, R. S., *1926*, A classification of the toothlike fossils, conodonts, with descriptions of American Devonian and Mississippian species: *U. S. Nat. Mus., Proc.*, vol. 68, art. 12.

WELLER, STUART, *1889*, A peculiar Devonian deposit in northeastern Illinois: *Jour. Geology*, vol. 7, pp. 483–488.

E. B. BRANSON AND M. G. MEHL, UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI. MANUSCRIPT RECEIVED BY THE EDITOR, JULY 20, 1937.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 167–169, PL. 27, MARCH, 1938.

TRIPLALEPIDINA VERACRUZIANA, A NEW GENUS AND SPECIES OF ORBITOIDAL FORAMINIFERA FROM THE EOCENE OF MEXICO

THOMAS WAYLAND VAUGHAN AND W. STORRS COLE

ABSTRACT

This article presents a description of *Triplalepidina veracruziana*, a new genus and species of orbitoidal Foraminifera, from the upper Eocene Tantoyuca formation near Palma Sola, Vera Cruz, Mexico. The most distinctive feature is the separation of the equatorial layer near the periphery into three zones.

Genus TRIPLALEPIDINA Vaughan and Cole, n. gen.

Genotype, *Triplalepidina veracruziana* Vaughan and Cole.

Since this genus is based on a single species, the specific description will serve to characterize the genus. Only comments are needed here. *Triplalepidina* is very similar to *Lepidocyclina* Gümbel, except that the equatorial layer is divided into three zones near the periphery of the test. Two layers of small equatorial chamberlets are separated by a wedge-shaped layer of clear shell material. In various species of *Lepidocyclina* and its subgenera, the equatorial layer is commonly separated into chamberlets near the periphery, but these chamberlets are never separated by a distinct wedge of shell material.

TRIPLALEPIDINA VERACRUZIANA Vaughan and Cole, n. sp.

Plate 27, figures 1–9

Test small, shape ranging from evenly lenticular to slightly asymmetrical lenticular, sloping regularly from the central inflated part to the margin, with or without a very narrow marginal flange. Outline in plan irregularly subcircular or faintly polygonal. The surface ornamentation consists of a reticulate mesh, with or without apical papillae. The papillae when present are nearly flush with the surface and vary in number from 1 to 2. The diameter of the smallest specimen measured was 1.5 mm. and the thickness through the center was 0.6 mm. The diameter of the largest specimen observed was 3.1 mm. and the thickness was 1.1 mm. Average specimens have a diameter of about 2.5 mm. and a thickness of 0.9 mm. No microspheric individuals were found.

The embryonic apparatus consists of two subequal chambers which are divided by a straight wall. There are two or more accessory chambers surrounding these. The length of the two chambers, including the walls, ranges from 0.23 to 0.36 mm. In the smallest embryonic apparatus measured, the larger chamber had internal diameters of 0.13×0.11 mm.; the smaller chamber, internal diameters of 0.12×0.08 mm. In the largest embryonic apparatus measured, the larger chamber had internal diameters of 0.27×0.16 mm.; the small chamber, internal diameters of 0.23×0.16 mm. The wall surrounding the embryonic chambers has a nearly constant thickness of 14μ. The height of the embryonic apparatus varies from 0.2 to 0.31 mm. Communication between the two embryonic chambers is by three stolons in the dividing partition.

The arrangement and shape of the supplementary chambers surrounding the embryonic apparatus will be noted by reference to plate 27, figures 1–3. The larger accessory chambers are usually on opposite sides of the embryonic chambers

and adjacent to the ends of the dividing wall. The largest accessory chamber measured had an internal diameter of 0.12×0.04 mm.

The equatorial chambers have curved outer and converging inner walls, which in many chambers do not meet, producing a truncate end on the proximal side of the chamber. The chambers near the center are commonly larger with a radial diameter of about 64μ and a transverse diameter of 43 to 57μ. Smaller chambers near the periphery have transverse and radial diameters of about 29μ. Plate 27, figure 4, represents a portion of a decalcified balsam preparation of an equatorial section ×210. The purpose of this preparation was to show the stolon systems of the equatorial chambers, but it is not entirely satisfactory. The chamber walls appear dark in the figure; while the chamber cavities and the openings for the stolons are light grayish in color. The figure shows the oblique stolons, with at least four openings in each chamber. There are no indications of radial stolons. The presence or absence of annular stolons is left in doubt. In a letter from Tampico, dated July 29, 1936, Mr. Thomas F. Grimsdale wrote Vaughan indicating that there are no annular stolons as follows:

> I have lately come across a small number of specimens of unfilled *Triplalepidina veracruziana* your ms., and I have made successful decalcifications; I enclose photographs. You will note the uniserial stolons near the nucleoconch in the transverse section, and the four-stolon system in the equatorial section, the stolons being uncrossed.

In vertical sections, the thickness of the equatorial layer including the floor and roof is about 0.08 mm. at the center, at the point where it divides about 0.11 mm., and at the periphery about 0.21 mm. The outer portion of the equatorial layer is divided into three parts by a wedge-shaped layer of clear shell material about 0.5 mm. long with a peripheral thickness of about 0.08 mm. Above and below this wedge of clear shell material are layers of small equatorial chamberlets. Two stoloniferous apertures are found in the walls of the equatorial chambers (see pl. 27, fig. 8).

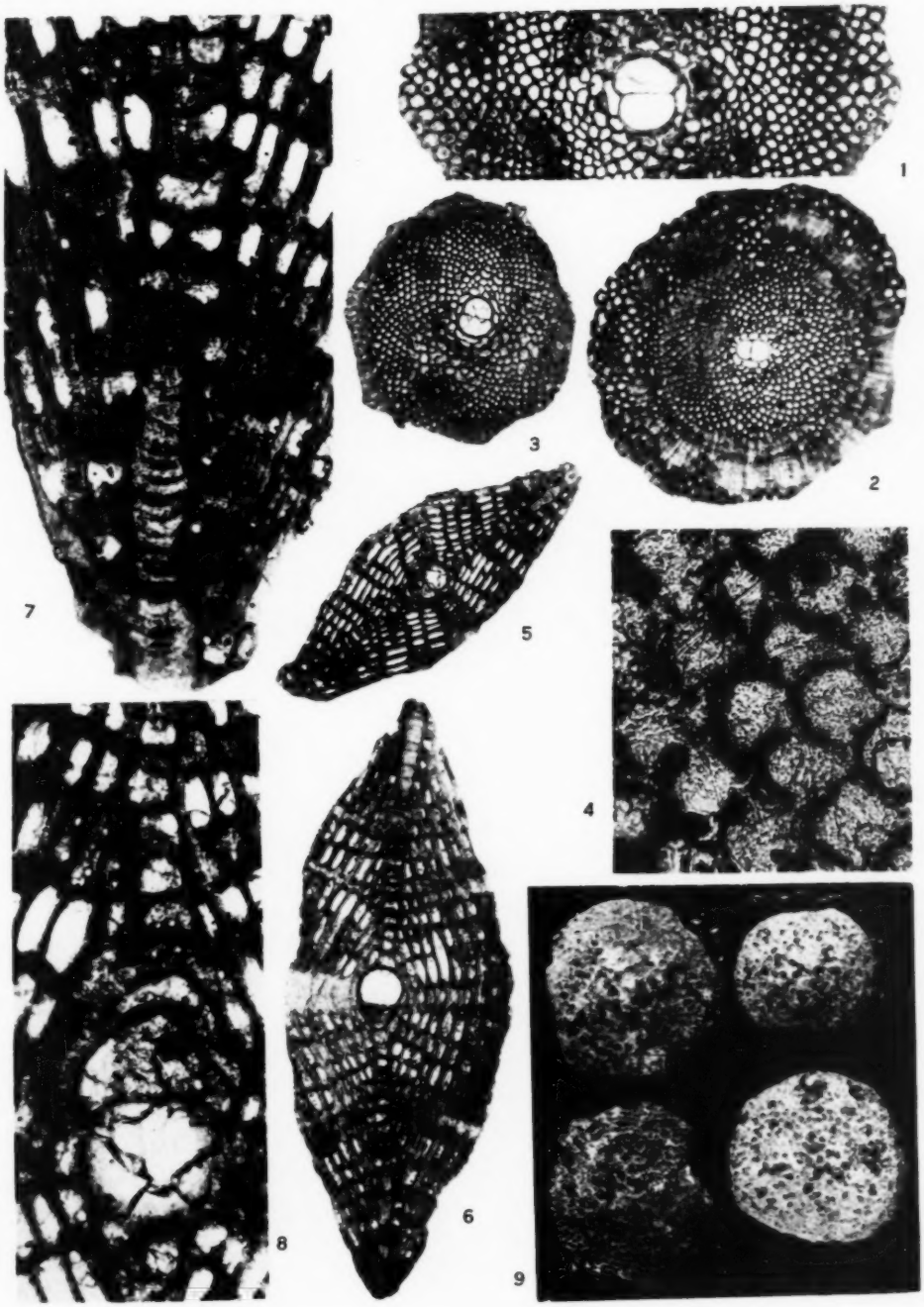
The lateral chambers as observed in vertical sections occur in regular tiers except in the central portion of the test where certain chambers extend over two tiers. There are 10 to 11 chambers to a tier on each side of the equatorial layer over the center of the test. The number of chambers decreases regularly toward the periphery, but the equatorial layer is usually covered by at least one layer of lateral chambers even at the margin of the test. The height of the lateral chambers, including the roof and floor through the center, is uniformly about 80μ; the length of the shorter chambers is about 100μ, while the longer, overlapping chambers have a length of about 200μ. The roofs and floors have a thickness of 14μ. Apertures for stolons are recognizable in a number of chambers. There are two to a chamber and they have a diameter of about 6μ.

Normally, there is a large pillar present on each side of the equatorial layer at the center. The surface diameter of these pillars is about 0.24 mm. They taper slightly as they approach the center of the test. A few very small pillars are oc-

---

EXPLANATION OF PLATE 27

FIGS. *1–9*—*Triplalepidina veracruziana* Vaughan and Cole, n. gen., n. sp. Syntypes, from Arroyo Torrero, Palma Sola, State of Vera Cruz, Mexico. *1*, Portion of an equatorial section, ×31.5. *2*, *3*, Equatorial sections, ×20. *4*, Decalcified Canada balsam preparation, ×210, of a portion of an equatorial section to illustrate the interchamber communication. *5*, *6*, Vertical sections, *5*, ×20; *6*, ×31.5. *7*, *8*, Portions of the vertical section fig. *5*, ×107, *7*, illustrating the threefold division of the equatorial zone near the periphery of the test; *8*, the equatorial zone at the center of the test. The shape and arrangement of the stoloniferous apertures of the equatorial and lateral chambers are clearly indicated. *9*, External view of four specimens, ×10. (p. 167)



Vaughan and Cole, Eocene Foraminifera

UNIV. OF MICH.

casionally noted between the tiers of lateral chambers. These are nearly of equal diameter from the surface to the equatorial layer with a diameter of 0.04 mm.

Occurrence.—Arroyo Torrero, Palma Sola, State of Vera Cruz, Mexico, from bed 10 of the Tantoyuca formation (upper Eocene); presented to T. W. Vaughan by Dr. D. R. Semmes, then a geologist of the Aguila Oil Company.

Remarks.—The occurrence of stoloniferous apertures in the walls of lateral chambers has been noted by Vaughan (1936) in *Helicolepidina nortoni*. Specimens of *Lepidocyclina yurnagunensis* Cushman and its variety *morganopsis* Vaughan from Trinidad in the collection at the U. S. Nat. Mus. also exhibit this feature.

Syntypes.—The specimens on which the foregoing description is based, and which are here illustrated, belong to the U. S. Nat. Mus.

REFERENCE

VAUGHAN, T. W., *1936, Helicolepidina nortoni*, a new species of Foraminifera from a deep well in St. Landry Parish, La.: *Jour. Paleontology*, vol. 10, no. 4, p. 250, pl. 40, fig. 4

T. WAYLAND VAUGHAN, WASHINGTON, D. C. W. STORRS COLE, OHIO STATE UNIVERSITY, COLUMBUS, OHIO. MANUSCRIPT RECEIVED BY THE EDITOR, DECEMBER 4, 1937.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 170–172, PL. 28, MARCH, 1938

SOME FORAMINIFERA OF THE FAMILY TEXTULARIIDAE FROM THE EOCENE OF CUBA

C. G. LALICKER AND P J. BERMÚDEZ

ABSTRACT

The relationship between the Textulariidae from the Eocene of Cuba and from other countries is discussed. Three new species of the genus *Textularia* are described.

The Eocene material upon which this paper is based was collected by P. J. Bermúdez while making systematic collections of Eocene foraminiferal material in the various provinces of Cuba.

There are a number of species in this collection which are present in adjacent areas, showing there is a definite relationship between the Eocene of Cuba and the Eocene of Trinidad, Mexico, southeastern United States, and southwestern France.

The holotypes and a representative collection are deposited in the Cushman Laboratory for Foraminiferal Research, Sharon, Mass., and paratypes and representative specimens are deposited in Museo Poey, the University of Havana, Havana, Cuba.

Vulvulina advena Cushman, which is found in the Eocene of Alabama and Mexico, is very common in the Eocene of Cuba, having been found at Bermúdez stations Nos. 20, 257, 283, 285, 312, and 345. (The Bermúdez stations are listed at the end of this paper.)

Vulvulina jarvisi Cushman, which was originally described from the Eocene of Trinidad, is abundant in the Cuban Eocene, being present at the following Bermúdez stations: Nos. 18, 31, 36, 268, 275, 337-A, 355, 357, 363, and 367.

Vulvulina pachyheilus Hadley, which was described from the Mariel formation, Oligocene age, Pinar del Rio Province, Cuba, is present at Bermúdez stations Nos. 36, 337-A, 357, and 363.

Spiroplectammina carinata (d'Orbigny) which was described as *Textularia carinata* from the Miocene of the Vienna Basin, and which is abundant in the Oligocene of Germany, the Eocene at Biarritz, France, and the Eocene of Italy, is found at Bermúdez stations Nos. 20, 92, 257, 283, 285, 312, and 351.

Textularia recta Cushman, originally described from the Eocene and Oligocene of Alabama and Mississippi, is found at Bermúdez stations Nos. 18, 36, 275, 337-A, and 363.

Textularia rugosa (Reuss), which was described as *Plecanium rugosum* from the Oligocene of France, is present at Bermúdez stations Nos. 110, 275, and 337-A.

SYSTEMATIC DESCRIPTIONS

Genus TEXTULARIA Defrance, 1824

TEXTULARIA MARIELENSIS Lalicker and Bermúdez, n. sp.

Plate 28, figures 1*a*–2

Test triangular in front view, subrectangular in top view, compressed, thickest at apertural end, gradually increasing in thickness, periphery sharp, spinose; chambers numerous, low and broad, the upper margin of each chamber slightly overlapping lower edge of each subsequent chamber, each chamber typically terminating at the peripheral margin in a short spine, apertural margin of chambers flattened to somewhat depressed; sutures distinct, slightly depressed, gently curved upward; wall finely arenaceous with a large proportion of calcareous cement, smoothly finished; aperture a very low, broad, rather indistinct opening at the inner margin of

the last-formed chamber, in a distinct reëntrant. Length of holotype, 0.82 mm.; greatest width, 0.82 mm.; thickness, 0.37 mm.

Type.—Holotype (Cushman coll., no. 23,751) from upper Eocene, 4.5 kms. west of Guanajay, on road to Mariel, Pinar del Rio Province, Cuba. Collected by P. J. Bermúdez, station No. 337-A. This species is also present at Bermúdez station No. 363.

Remarks.—This species is more like *Textularia lateralis* Lalicker, from off the North Coast of Porto Rico, than any other. It differs from that species in being more flattened, in having the upper margin of each chamber distinctly overlapping, in having a sharper peripheral margin, and in having distinct spines on the end of each chamber. The sutures in *T. marielensis* Lalicker and Bermúdez are arched upward more than in *T. lateralis*.

TEXTULARIA CUBENSIS Lalicker and Bermúdez, n. sp.
Plate 28, figures 3*a–c*

Test thick, subrhomboidal in front view, rectangular in top view, thickest at apertural end, periphery subacute; chambers few, low and broad, the upper margin of each chamber greatly thickened, causing it to overhang lower portion; sutures rather indistinct, being in a groove between raised upper margins of chambers; wall finely arenaceous, slightly roughened, with a large proportion of calcareous cement, thick; aperture a broad rather highly arched opening at the inner margin of the last-formed chamber, in a distinct reëntrant. Length of holotype, 0.75 mm.; greatest width, 0.74 mm.; thickness, 0.50 mm.

Type.—Holotype (Cushman Coll., no. 23,752) from upper Eocene, type locality, Principe formation, Loma Principe, cut between F and Avenida de los Presidentes Sts., 20 meters west of Monument Vedado, Havana, Cuba. Collected by P. J. Bermúdez, station No. 345. This species was not noted at any other localities in Cuba.

Remarks.—This species is similar to *Textularia excavata* Cushman, from the Pacific Ocean, but differs in having a greater overlap of the chambers, and in having a longer test in proportion to the width. It is also somewhat like *T. albatrossi* Cushman, but differs in having the aperture at the base of the last-formed chamber instead of above the base with a distinct lip, as in *T. albatrossi*.

TEXTULARIA MAGNIFICA Lalicker and Bermúdez, n. sp.
Plate 28, figures 4*a–c*

Test large, subovoid in front and side views, subrectangular in top view, widest and thickest near apertural end, periphery broadly rounded throughout; chambers few, about as high as broad, the apertural chambers being rounded; sutures very indistinct, marked by a slight depression between the chambers; wall coarsely arenaceous, roughened, with calcareous cement between calcareous grains and small tests of other foraminifera, thick; aperture a low, broad, rather indistinct opening at the inner margin of the last-formed chamber. Length of holotype, 2.55 mm.; greatest width, 1.85 mm.; greatest thickness, 1.70 mm.

Type.—Holotype (Cushman coll., No. 23,400) from upper Eocene, Principe formation, Tejar Consuelo quarry (upper beds), Cerro, Havana, Cuba. Collected by P. J. Bermúdez, station No. 36. It is also present at Bermúdez stations Nos. 109, 337-A, and 367.

List of Bermúdez Stations

Station No.

18, Upper Eocene, Principe formation, Alturas de Almendares quarry, west side of Almendares River, Havana, Cuba.

20, Lower Eocene, Universidad formation (=Aragon formation, Mexico), Avenida de los Presidentes, Vedado, Havana, Cuba.

31, Upper Eocene, 1 km. north of Arroyo Arenas, on road to Jaimanitas, Havana Province, Cuba.

36, Upper Principe formation, upper Eocene, Tejar "Consuelo" quarry (upper beds), Cerro, Havana, Cuba.

92, Middle Eocene, under R.R. bridge on

highway in Jicotea, Santa Clara Province, Cuba.
109, Middle Eocene, Santa Catalina, 4 kms. northwest of Yaguajay, Santa Clara Province, Cuba.
110, Middle Eocene, Peñón Hole, 7 kms. south of Martí, Matanzas Province, Cuba.
257, Lower Eocene, type locality, Universidad formation, under Havana University Library, Havana, Cuba.
268, Upper Eocene, Noroña, north of Guanajay, Pinar del Rio Province, Cuba.
275, Same as 268 (lower beds).
283, Lower Eocene, Universidad formation, Tejar "Consuelo" quarry (lower beds), Cerro, Havana, Cuba.
285, Lower Eocene, "Cantera Grande," east side of Almendares River, Havana, Cuba.
286, Same as station 36 (Resample).
312, Lower Eocene, El Husillo quarry, Puentes Grandes, Havana, Cuba.
337-A, Upper Eocene, Jabaco formation, 4.5 kms. west of Guanajay on road to Mariel, Pinar del Rio Province, Cuba.
345, Upper Eocene, type locality, Principe formation, Loma Principe, cut between F and Avenida de los Presidentes Sts., 20 meters west of Monument Vedado, Havana, Cuba.
351, Lower Eocene, Tejar Toledo, Marianao, Havana, Cuba.
355, Middle Eocene, 5 kms. west of Palma Soriano, Central Highway cut, Oriente Province, Cuba.
357, Highway cut, 13.5 kms. west of Palma Soriano, Oriente Province, Cuba.
363, Highway cut, 4 kms. west of Baire; 47 kms. west of Palma Soriano, Oriente Province, Cuba.
367, Upper beds at R. R. Station in F. C. C. of Hershey, one-half km. north of Peñas Altas, Havana Province, Cuba.

REFERENCES

COLE, W. S., *1928*, A foraminiferal fauna from the Chapapote formation in Mexico: *Bull. Am. Paleontology*, vol. 14, no. 53, pp. 1–32, pls. 1–4.

CUSHMAN, JOSEPH A., *1921*, Foraminifera of the Philippine and adjacent seas: *U. S. Nat. Mus., Bull.* 100, vol. 4, 608 pp., 52 text figs., 100 pls.

———, *1923*, The Foraminifera of the Vicksburg group: *U. S. Geol. Survey, Prof. Paper* 133, pp. 11–71, pls. 1–8.

———, *1926*, Some new Foraminifera from the upper Eocene of the southeastern coastal plain of the United States: *Cushman Lab. Foram. Research, Contr.*, vol. 2, pp. 29–38, pls. 4, 5.

———, *1932*, The genus *Vulvulina* and its species: *Cushman Lab. Foram. Research, Contr.*, vol. 8, pt. 4, pp. 75–85, pl. 10.

HADLEY, WADE H., JR., *1934*, Some Tertiary Foraminifera from the North Coast of Cuba: *Bull. Am. Paleontology*, vol. 20, no. 70A, pp. 1–40, pls. 1–5.

LALICKER, CECIL G., *1935*, Two new Foraminifera of the genus *Textularia: Smithsonian Misc. Coll., Johnson Fund*, vol. 91, no. 22, pp. 1, 2, pl. 1.

ORBIGNY, ALCIDE D', *1846*, *Foraminifères fossiles du Bassin Tertiaire de Vienne*. 4to. Paris, 312 pp., pls. 1–21.

REUSS, A. E., *1869*, Zur fossilen Fauna der Oligocänschichten von Gaas: *Sitz. Akad. Wiss. Wien*, vol. 59, Abth. 1, pp. 446–486, pls. 1–6.

C. G. LALICKER, PHILLIPS PETROLEUM COMPANY, CORPUS CHRISTI, TEXAS. P. J. BERMÚDEZ, MUSEO POEY, UNIVERSITY OF HAVANA, HAVANA, CUBA. MANUSCRIPT RECEIVED BY THE EDITOR, DECEMBER 1, 1937.

EXPLANATION OF PLATE 28

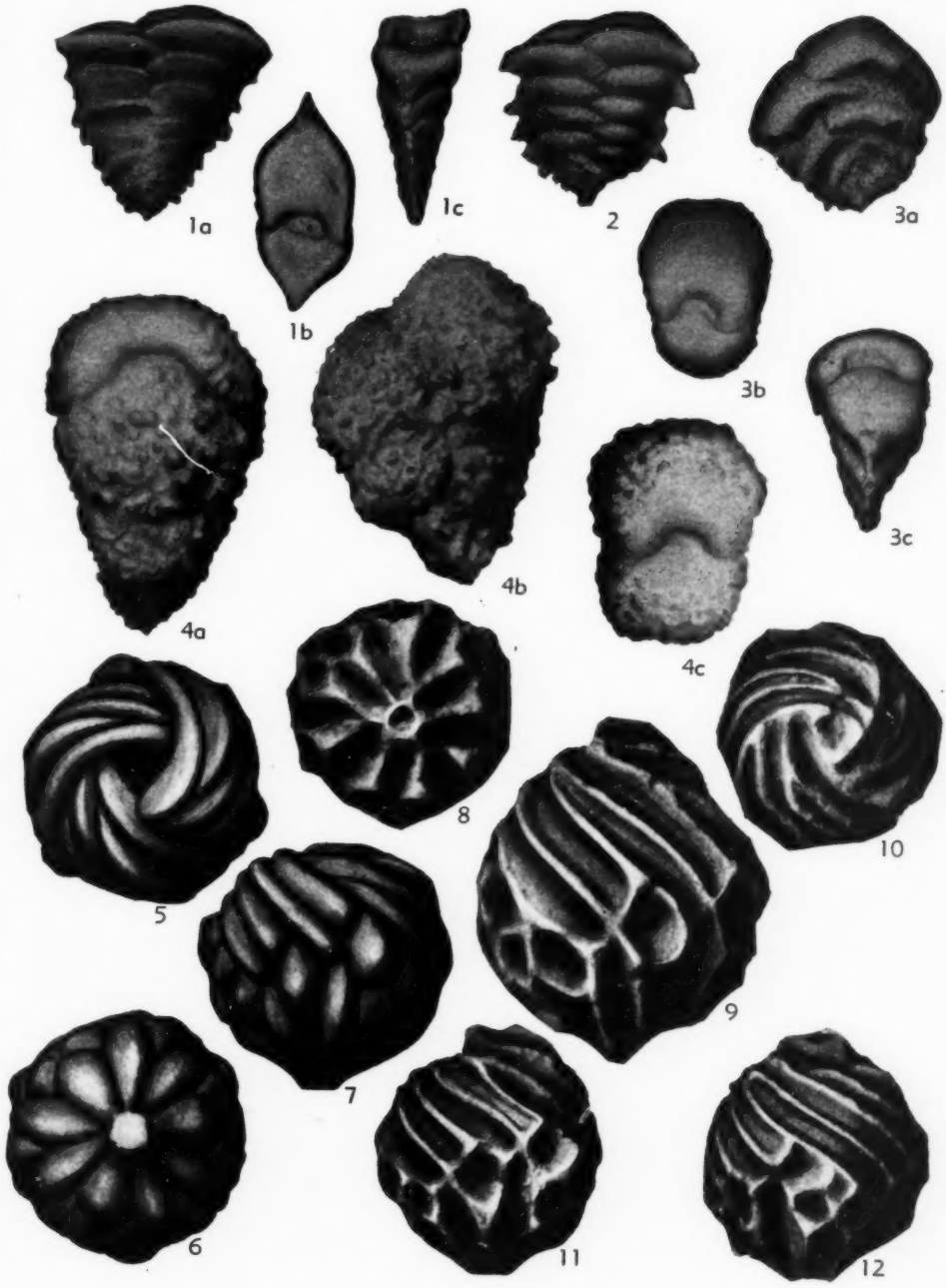
FIGS. *1a–2—Textularia marielensis* Lalicker and Bermúdez, n. sp. *1*, Holotype, ×28; *2*, paratype, ×40. *a*, Front view; *b*, top view; *c*, side view. Upper Eocene, Pinar del Rio Province, Cuba. (p. 170)

3a–c—Textularia cubensis Lalicker and Bermúdez, n. sp. Holotype, ×28. *a*, Front view; *b*, top view; *c*, side view. Upper Eocene, Loma Principe, Havana, Cuba. (p. 171)

4a–c—Textularia magnifica Lalicker and Bermúdez, n. sp. Holotype, ×13. *a*, Side view; *b*, front view; *c*, top view. Upper Eocene, Cerro, Havana, Cuba. Figures 1*a*–4*c* drawn by Ann Shepard. (p. 171)

5–7—Summit, lateral, and basal views of a plaster model illustrating the probable appearance of a specimen of *Atopochara trivolvis* Peck, n. sp., on which the enveloping cells became almost filled with calcite. ×33. (p. 174)

8–12—Atopochara trivolvis Peck, n. sp. *8*, *10–12*, Basal, summit, and lateral views of holotype from Magnolia No. 3 at 550 ft., Marshall County, Okla. *9*, Lateral view of paratype from Sun-Williams No. 1 at 400 to 420 feet, Irion County, Tex. ×33. (p. 174)



Lalicker and Bermúdez, Eocene Foraminifera
Peck, Cretaceous Charophytes

UNIV. OF MICH.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 173–176, PL. 28, TEXT FIG. 1, MARCH, 1938.

A NEW FAMILY OF CHAROPHYTA FROM THE LOWER CRETACEOUS OF TEXAS

RAYMOND E. PECK

ABSTRACT

A new family containing one new genus (*Atopochara*) of charophyte oogonia is described from the Lower Cretaceous of Texas. The genus is represented by a single species. The systematic position of the new genus and the structures of the oogonia representing it are discussed.

Over a period of several years geologists working with cuttings from deep wells in south-central Texas and Oklahoma have recognized certain small highly ornamented spherical fossils as good markers for the Lower Cretaceous.

Collections of these oogonia, totaling 25 specimens, have been given to me by Mr. E. R. Branson and Mr. John Ware of Tulsa, Okla., and Mr. Henry Morgan, Jr. of San Angelo, Tex. I am also indebted to Mr. Morgan for information concerning the stratigraphic distribution of the fossils.

TEXT FIG. 1—*Atopochara trivolvis* Peck, n. sp. Plan drawing to show 36 units divided into three rays. ×28. (p. 174)

In size, shape, and general configuration, these small fossils closely resemble the oogonia of modern and fossil charophytes, but they differ from all recorded charophyte oogonia to such a degree that it is impossible to refer them to any of the defined families.

The retouched photographs, the plan drawing, and the plaster model illustrated in figs. 5–7 were prepared by Vaona H. Peck.

SYSTEMATIC DESCRIPTIONS

Family ATOPOCHARACEAE Peck, new family

The characteristics of the family must remain those of the single genus referred to it until other genera are recognized.

Genus ATOPOCHARA Peck, new genus

Small globular oogonia about 1 mm. in diameter, on which is developed a three-rayed symmetry. Each ray consists of three vertical units originating at or near the basal opening and ascending to or near the equatorial plane; five small units grouped on or near the equatorial plane; and four sinistrally spiralled units extending from slightly above the equatorial plane to or near the summit opening. The name is derived from ἄτοπος, meaning strange, odd, absurd.

Genotype, *Atopochara trivolvis* Peck, n. sp., from the Glen Rose of Texas.

Remarks.—The amount of calcite secreted within the enveloping cells of the charophyte oogonium is a variable character, even within a species or on the same plant (Peck, 1934, p. 89). On all the specimens of *A. trivolvis* examined, 33 of the units consist of deep broadly rounded furrows or pits. The other three units, always the small pits on the right-hand side of each ray, are flattened areas. It is possible that some representatives of the Atopocharaceae, or of specimens of *A. trivolvis*, secreted more calcite than the specimens studied, and future investigations will reveal individuals with shallow furrows or cellular ridges. Figures 5–7, plate 28, are photographs of a plaster model indicating the probable appearance of a specimen of *A. trivolvis* on which the enveloping cells had become almost filled with calcite.

ATOPOCHARA TRIVOLVIS Peck, n. sp.
Plate 28, figures 8–12; Text figure 1

Oogonium globose, fairly large, averaging about 0.8 to 0.9 mm in both width and length, composed of 36 divisions divided into three distinct structural units. Each unit consists of three vertical furrows in the lower part, five somewhat diamond-shaped pits near the equatorial plane, and four sinistrally spiralled furrows on the upper part.

Each of the three units originates at the basal opening as two comparatively broad vertical furrows between which, almost immediately, a third furrow is introduced. The right-hand furrow of each unit is short but rapidly expanding, ascending vertically for about one-fourth the total height of the specimen and terminating between two fairly large diamond-shaped pits. Located between the upper sides of the pits is a third somewhat smaller four-sided pit, and situated on the upper left sides of the lower left pit and the upper central pit is a large pentagonal pit. Originating on the upper left side of the large pentagonal pit is an elongate furrow ascending sinistrally at an angle of about 40 degrees from the vertical, recurving near its terminus to form one side of a small but conspicuous summit opening.

The central vertical furrow ascends to approximately the equatorial plane of the specimen, contracting slightly in width distally and terminating partly against the large pentagonal pit and partly against a low ridge that makes an angle of about 12 degrees with the equatorial plane. Arising on the upper side of the low ridge is a second sinistrally ascending furrow that fails to reach the summit by pinching out between two adjoining furrows.

Located between the distal thirds of the central and left-hand furrows is another large pit, and arising on the upper left side of this pit is a third sinistrally ascending furrow that recurves slightly and terminates against the right-hand sinistrally spiralled furrow of the next unit on the left.

The left-hand vertical furrow ascends almost to the equatorial plane of the specimen. It narrows slightly in the upper third between the right-hand pit of the next unit on the left and the large pit on the right, and terminates against a low ridge that makes an angle of approximately 12 degrees with the equatorial plane. Arising on the upper side of the low ridge is the fourth sinistrally spiralled furrow. This furrow also does not reach the summit, but terminates against the right-hand furrow of the next unit in the left.

Occurrence.—Glen Rose of the Trinity (Lower Cretaceous) of Texas and Oklahoma. Specifically, from Sun-Williams well no. 1 at 400 to 420 feet, Irion County, Tex.; Chesapeake Allison well no. 1 at 525 feet, Sutton County, Tex.; Mid-Kansas Goode no. 1 at 770 to 790 feet, Terrell County, Tex.; Eastland et al. no. 1—near base of Lower Cretaceous—Schleicher County, Tex.; and Magnolia no. 3 at 530 feet, Ruthford lease, sec. 30, T. 5 S., R. 6 E., Marshall County, Okla. The slide of material from the Chesapeake-Allison well in Sutton County also contained *Chara* sp., and several of the slides contained ostracodes.

A letter (April 8, 1936) from Mr. Henry I. Morgan, Jr., of the Atlantic Oil Producing Company, gives the occurrence as

> certainly Trinity in age with the strong probability that it is all Glen Rose but with a possibility of the Sun-Williams no. 1 forms coming from the Paluxy.

Mr. Morgan also states that the material seems to be from a clastic facies in the Glen Rose.

Types.—Holotype and paratypes Univ. Missouri, no. 31014–2 and 31014–3.

Remarks.—The material on which the above description is based consists of 25 specimens, all of which are uniform in size, shape, and structure. Some of the individuals are slightly broader than long and others are longer than broad. In a few cases the sinistrally spiralled furrow that fails to reach either the summit or the next unit on the left is raised into a distinct prominence near its terminus—it seems to literally lap up onto the sides of the two adjoining furrows. The pit located between the two irregularly shaped pits arising from the right-hand furrow is always more shallow than the other pits and may exist as a flattened area instead of a depression.

SYSTEMATIC POSITION

Inasmuch as the charophytes were a well-defined group in Late Paleozoic, and seem to have deviated but little from the established type of oogonia since that time, the relationship of the unusual Atopocharaceae from the Lower Cretaceous would seem questionable. In the early part of the Pennsylvanian period (Cherokee) charophyte oogonia did not differ structurally from the oogonia of the living plants (Peck, 1934). The oogonia at that time consisted of five sinistrally spiralled units, and in only two authentic occurrences have oogonia been found in Pennsylvanian or younger rocks that differed from that established type. *Paleochara* Bell (1922), from the Carboniferous of Nova Scotia, possesses six sinistrally spiralled units. *Clavator* Reid and Groves (1916), a representative of the Charophyta from the Jurassic of England, resembles *Atopochara* in size and somewhat in configuration, but is defined as having the oogonia enclosed in an outer utricle. Sections have failed to show any indication of an inner oogonium in the Atopocharaceae. On the contrary, sections do indicate that the calcium carbonate of the furrows and pits was deposited in concave laminae, as it is in the cells of the modern charophytes.

The Atopocharaceae resemble the charophyte oogonia in size, shape, and in having two openings to the calcite filled interior, situated at opposite extremities. The calcareous wall of the Atopocharaceae is composed of units that correspond to the calcite units secreted within the enveloping cells of charophyte oogonia.

The problem of accounting for the numerous units in the oogonium wall can be more easily explained by considering the Atopocharaceae as primitive, rather than specialized plants. The initial discovery of the Atopocharaceae in rocks of Lower Cretaceous age could mean that they are present in older rocks and have been overlooked, or that they acquired the habit of calcification in Lower Cretaceous times. The chief difficulty with either premise is the seemingly short distribution of the family in geological time. Although they are small fossils, the unusual sculpture makes them conspicuous and not apt to be overlooked. If they existed as non-calcified organisms until Lower Cretaceous times, it seems strange that they should have so suddenly disappeared. A parallel case, however, is illustrated by the Sycidicaceae. The Sycidicaceae are abundant at some Devonian localities in Europe (Karpinsky, 1906) and have been found in only one formation (lower Mississippian) and at only one locality (Peck, 1934) in North America. They are about the same size as the Atopocharaceae and their reticulate structure makes them even more conspicuous in samples. If the Atopocharaceae can be considered primitive and it can be as-

sumed that either of the two premises given above is correct, the relationship of this family to the Characeae can be logically explained in the same manner as the relationship of the Sycidaceae to the Trochiliscaceae.

The initial stage in the development of a charophyte oogonium consists of a small number of cells budding off the node cell and ascending vertically. At a later stage these enveloping cells cover and protect the oospore. To adequately cover a more or less spherical oospore of appreciable size, some modification of this small number of simple vertical cells must be introduced. This modification takes the form of one, or a combination of two or more possibilities. The spherical oogonia of the Trochiliscaceae and Characeae are primarily the result of the lengthening and spiral twisting of the enveloping cells. In the Sycidaceae the same result is obtained by a vertical division of the simple cells to produce a larger number of vertical cells about the periphery of the specimens. A combination of both modifications is evident in the enveloping cells of the Atopocharaceae.

On the Atopocharaceae six cells budded off the node cell and ascended vertically. Three of these cells, probably the left-hand cell of each unit, divided longitudinally to form nine vertical cells in the lower part of the oogonium. Near or below the periphery these vertical cells terminated and several small cells arose at their distal ends. Thus the increased girth was protected by an increase in the number of cells. Arising from these small cells on the equatorial plane four cells ascended toward the summit opening with a sinistral spiral. As they neared the summit opening, the decreased circumference was compensated for by a narrowing of the spiral cells and the actual suppression of one of them in each of the three units.

REFERENCES

BELL, W. A., *1922*, A new genus of Characeae and new Merostoma from the Coal Measures of Nova Scotia: *Royal Soc. Canada, Proc. and Trans.*, 3d ser., vol. 16, pp. 159–168.

KARPINSKY, A., *1906*, Die Trochilisken: *Memoirs du Comite Geologique*, Nouvelle serie, Livr. 27.

PECK, RAYMOND E., *1934*, The North American Trochiliscids, Paleozoic Charophyta: *Jour. Paleontology*, vol. 8, pp. 83–119, pls. 8–13.

———, *1934*, Late Paleozoic and Early Mesozoic Charophyta: *Am. Jour. Sci.*, 5th ser., vol. 27, pp. 49–55.

REID, C., and GROVES, J., *1916*, Preliminary report on the Purbeck Characeae: *Proc. Royal Soc.*, B, vol. 89, pp. 252–256.

RAYMOND E. PECK, UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI. MANUSCRIPT RECEIVED BY THE EDITOR, NOVEMBER 4, 1937.

JOURNAL OF PALEONTOLOGY, VOL. 12, NO. 2, PP. 177–208, MARCH, 1938

BIBLIOGRAPHY AND INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEAR 1935

HANS E. THALMANN

The following Bibliography comprises 427 titles of publications devoted exclusively or partly to Foraminifera. Besides 353 publications issued in 1935, 10 are added for the year 1931, 13 for 1932, 16 for 1933, and 35 for 1934.

I wish to express my sincere thanks to all authors who kindly have forwarded their publications to me, or have contributed in some way to make the annual bibliography of Foraminifera as complete as possible. Invaluable help has been rendered by Dr. Frederick Chapman (Melbourne), Prof. Dr. Ichiro Hayasaka (Taihoku), Dr. Franz Kahler (Klagenfurt), Dr. Th. Kräutner (Budapest), Dr. W. A. Macfadyen (Baghdad), Mr. Walter J. Parr (Melbourne), Mrs. Helen Jeanne Plummer (Austin), Dr. Hans H. Renz (Berne), Prof. Dr. O. H. Schindewolf (Berlin), Prof. Dr. H. Yabe (Tokyo), and Mrs. Heidi Thalmann.

From the foraminiferal literature of the year 1935 there have been recorded in the following index 3 new subfamilies, 21 new genera, 5 new subgenera, 237 new species, 42 new varieties or formae, and 67 species of Foraminifera, to which the *nomenclatura aperta* has been applied. Three *nomina nuda* are also listed. As supplements to the indexes for the years 1931 to 1934 are added 2 new superfamilies, 5 new families, 4 new subfamilies, 1 new genus (change of name), 6 new species, and 1 new variety.

Throughout the Index the term "generotype" has been used for "genotype" or "genoholotype" in order to avoid confusion with the equivocal homonym used in genetics and heredity. In accordance with Article 3 of the *International Rules of Zoological Nomenclature*, the designations "gen. nov.", "spec. nov." and "var. nov." are applied instead of "nov. gen." etc. so often met with in current publications. This has been done to avoid the habit of each country in placing such designations in its own language after the Latin name.

Homonyms.—According to Articles 11, 34 and 35 of the *International Rules of Zoological Nomenclature*, the following forms, established during 1935, are homonyms and, consequently, should be renamed by their respective authors:

Adhaerentina Paalzow, preoccupied by Spandel, 1909, for a middle Oligocene genus.

Bolivina cubana Bermudez, preoccupied by *B. lobata*, H. B. Brady, 1881, var. *cubensis* Cushman, 1919. (See note, p. 208.)

Bulimina ornata Cushman and Parker, preoccupied by Egger, 1893. (Note: This homonym has been changed to *B. rudita* nom. nov. by the authors in 1936.)

Pseudofusulina lutugini (Schellwien, 1908) var. *fragilis* Rauser-Cernoussova, preoccupied by *P. chihsiaensis* (Lee, 1931) var. *fragilis* Chen, 1934.

Staffella moellerana Thompson, preoccupied by Ozawa, 1925. (See note, p. 208.)

Uvigerina ampullacea H. B. Brady, 1884, var. *ampullacea* Campbell, preoccupied by *U. asperula* Czjzek, 1847, var. *ampullacea* H. B. Brady, 1884.

Uvigerina ampullacea H. B. Brady, 1884, var. *nuda* Campbell, preoccupied by *U. nuda* Terquem, 1882.

Vaginulina biochei Berthelin, 1880, var. *elongata* Eichenberg, preoccupied by *?V. elongata* Roemer, 1841, and d'Orbigny, 1849.

For sake of completeness and in compliance with Articles 11, 34 and 35 of the *International Rules of Zoological Nomenclature*, the following homonyms, which were omitted in the Indexes for the years *1931* to *1934*, should be renamed by their respective authors:

Bolivina advena Cushman, 1925, var. *elongata* Pijpers, 1933, *Univ. Utrecht, Diss.*, p. 67, text figs. 87, 88, is preoccupied by *B.*

elongata Hantken, 1875 (1876), *A magy. kir. földt. int. evkönyve*, vol. 4, p. 55, pl. 8, fig. 14.

Bolivina gracilis Cushman and Applin, 1926, var. *danvillensis* Howe and Wallace, 1932, *Louisiana Dept. Cons., Geol. Bull.* 2, p. 57, pl. 11, fig. 7, is preoccupied by the same authors in the same publication, namely *B. danvillensis*, p. 56, pl. 11, fig. 8.

Cibicides floridanus (Cushman, 1918) var. *cushmani* Barbat and von Estorff, 1933, *Jour. Paleontology*, vol. 7, p. 173, pl. 23, fig. 21, is preoccupied by *C. cushmani* Nuttall, 1930, *Jour. Paleontology*, vol. 4, p. 291, pl. 25, figs. 3, 5, 6.

Cibicidinae subfam. nov. Galloway, 1933, *A manual of Foraminifera*, p. 290, is preoccupied by Hofker, 1930, *Siboga Exped., Mon.*, vol. 4*a*, pt. 2, p. 125.

Cristellaria calcar (Linné, 1758) var. *alazanensis* Nuttall, 1932, *Jour. Paleontology*, vol. 6, p. 9, pl. 1, fig. 9, is preoccupied by *C. alazanensis* Cushman, 1927, *Jour. Paleontology*, vol. 1, p. 152, pl. 23, fig. 13.

Cristellaria (*Planularia*) *thalmanni* Pijpers, 1933, var. *costata* Pijpers, 1933, *Univ. Utrecht, Diss.*, p. 60, text fig. 31, is precoccupied by *Planularia costata* Cornuel, 1848 [not *Cristellaria costata* (Fichtel and Moll, 1798) and not *Cristellaria costata* Hosius, 1892], *Soc. géol. France, Mém.*, ser. 2, vol. 4, p. 253, pl. 2, figs. 5–8.

Cycloclypeus papillosus Hadley, 1934, *Bull. Am. Paleontology*, vol. 70A, p. 14 (118), pl. 1, fig. 17. is preoccupied by *Cyclocylpeus guembelianus* H. B. Brady, 1881, var. *papillosa* Silvestri, 1895, *Accad. Sci. Acireale, Atti e Rend.*, new ser., vol. 7, p. 57.

Discocyclina umbo (Schafhäutl, 1846) var. *minor* Meffert, 1931, *United Geol. Prosp. Service U.S.S.R., Trans.*, fasc. 99, p. 28, pl. 6, figs. 1–5; pl. 7, fig. 2; text figs. 4–6, is preoccupied by *Discocyclina dispansa* (Sowerby, 1837) var. *minor* L. Rutten, 1915, *Geol. Reichs-Mus. Leiden, Samml.*, ser. 1, vol. 10, p. 10, pl. 1, figs. 4, 5.

Elphidium advenum (Cushman, 1922) var. *depressula* Cushman, 1933, *U. S. Nat. Mus., Bull.* 161, p. 51, pl. 12, fig. 4, is preoccupied by *Polystomella* (=*Elphidium*) *depressula* G. B. Sowerby, 1856, *Forams. Colne Tidal River* (printed privately), plate, fig. 1.

Frondicularia carinthiaca Liebus, 1927, var. *carinata* Jedlitschka, 1932, *Naturwiss. Ver. Troppau, Mitt.*, p. 10, plate, fig. 16, is preoccupied by *F. carinata* Burbach, 1886, *Naturwiss. Halle, Zeitschr.*, vol. 59, p. 47, pl. 1, figs. 17–20, 29.

Frondicularia varians Russo, 1933, *Soc. géol. France, Bull.*, sér. 5, vol. 3, p. 359, pl. 16, fig. 10, is preoccupied by *F. varians* Terquem, 1866, *Sixième Mém. Foram. Lias*, p. 481, pl. 19, fig. 15.

Heterostegina gigantea David, 1933, *Haute-Comm. Rép. Franç. Syrie et Liban, Notes et Mém.*, vol. 1, sect. Géol., p. 125, pl. 8, fig. 3, is preoccupied by *H. papyracea* Seguenza, 1880, var. *gigantea* Seguenza, 1880, *R. accad. Lincei, Atti*, ser. 3, vol. 6, p. 56, pl. 7, fig. 2.

Lagena bicarinata (Terquem, 1882) var. *occlusa* Heron-Allen and Earland, 1932, *Discovery Reports*, vol. 4, p. 380, pl. 11, figs. 23–28, is preoccupied by *L. fimbriata* H. B. Brady, 1881, var. *occlusa* Sidebottom, 1912, *Queckett Micr. Soc., Jour.*, ser. 2, vol. 11, no. 70, p. 423, pl. 20, figs. 27, 28.

Lagena formosa Schwager, 1866, var. *costata* Earland, 1933, *Discovery Reports*, vol. 7, p. 111, pl. 5, figs. 16–18, is preoccupied by *L. costata* (Williamson, 1858, *Entosolenia*) *Rec. Foram. Great Brit.*, p. 9, pl. 1, fig. 18.

Lagena globosa (Montagu, 1803) var. *caudigera* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 119, pl. 18, fig. 214, is preoccupied by *L. alveolata* H. B. Brady, 1884, var. *caudigera* H. B. Brady, 1884, *Challenger Rept., Zoology*, vol. 9, p. 488, pl. 60, fig. 25.

Lagena marginata (Walker and Boys, 1784) var. *carinata* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 121, new variety for *L. marginata* in Brady, 1884, *Challenger Rept., Zoology*, vol. 9, p. 476, pl. 59, fig. 23, is preoccupied by *L. fasciata* (Egger, 1857) var. *carinata* Sidebottom, 1906, *Manchester Lit. Philos. Soc., Mem.*, p. 7, pl. 1, fig. 17.

Lagena marginata (Walker and Boys, 1784) var. *ventricosa* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 120, pl. 19, fig. 222, is preoccupied by *L. ventricosa* Silvestri, 1903, *Accad. sci. Torino, Mem.*, vol. 39, p. 10, text fig. 6.

Lagena ovata (Terquem, 1858) var. *caudigera* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 119, pl. 18, fig. 215, is preoccupied by *L. alveolata* H. B. Brady, 1884, var. *caudigera* H. B. Brady, 1884, *Challenger Rept., Zoology*, vol. 9, p. 488, pl. 60, fig. 25.

Lagena pannosa Millett, 1901, var. *simplex* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 118, new variety for *L. pannosa* Millett, 1901, *Royal Micr. Soc., Jour.*, pl. 1, fig. 14, is preoccupied by *L. simplex* (Reuss, 1851, *Oolina*), *Haidinger's Naturwiss. Abh.*, vol. 4, pt. 1, p. 22, pl. 1, fig. 2.

Lagena quadrilatera Earland, 1934, var. *striatula* Earland, 1934, *Discovery Repts.*, vol. 10, p. 160, pl. 7, fig. 9, (and *Lagena sublagenoides* Cushman, 1931, var. *striatula* Cushman 1913, *U. S. Nat. Mus., Bull.* 71, pt. 3, p. 40, pl. 16, fig. 5) is preoccupied by *L. striatula* (Egger, 1857, *Oolina*), *Neues Jahrb.*, p. 269, pl. 5, figs. 3–8.

Lagena striata (d'Orbigny, 1839) var. *interrupta* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 119, pl. 18, fig. 213, is preoccupied by *L. striata* (Walker and Jacob, 1784) var. *interrupta* Williamson, 1848, *Annals and Mag. Nat. History*, ser. 2, vol. 1, p. 14, pl. 1, fig. 7.

Lepidocyclina (*Multilepidina*) *irregularis*

Hanzawa, 1932, *Imp. Acad. Tokyo, Proc.*, vol. 8, no. 9, p. 448, text figs. 1–6, is preoccupied by *L. formosa* Schlumberger, 1902, var. *irregularis* L. Rutten, 1912, *Geol. Reichs-Mus. Leiden, Samml.*, vol. 9, p. 215, pl. 13, figs. 1–4.

Miliolina tricarinata (d'Orbigny, 1826) var. *crucioralis* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 105, is preoccupied by *Miliolina costifera* (Terquem, 1878) var. *crucioralis* Wiesner, 1931, *idem*, p. 105, pl. 15, fig. 174.

Miliolina trigonula (Lamarck, 1804) var. *angusteoralis* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 104, is preoccupied by *M. seminulum* (Linné, 1767) var. *angusteoralis* Wisener, 1912, *Arch. Protist. Kde.*, vol. 25, p. 233, text fig. 4.

Nodosaria verneuili d'Orbigny, 1846, var. *paucicostata* Pijpers, 1933, *Univ. Utrecht, Diss.*, p. 64, text figs. 58, 59, is preoccupied by *N. subscalaris* Cushman, 1917, var. *paucicostata* Cushman, 1917, *U. S. Nat. Mus., Proc.*, vol. 51, p. 654.

Nonion scapha (Fichtel and Moll, 1798) var. *inflata* Cushman and Ellisor, 1932, *Cushman Lab. Foram. Research, Contr.*, vol. 8, p. 41, pl. 6, fig. 2, (and *Nonionina turgida* (Williamson, 1858) var. *inflata* Shubert, 1900, *Deutsch. Nat. Med. Ver. Lotos, Sitzber.*, pl. 1, fig. 6) is preoccupied by *Nonionina inflata* Alth, 1849 (1850), *Haidinger's Naturwiss., Abh.*, vol. 3, pt. 2, p. 266, pl. 13, fig. 22.

Operculina samanica Berry, 1932, *Washington Acad. Sci., Jour.*, vol. 22, no. 1, p. 9, text fig. 2, is preoccupied by *O. atascaderensis* Berry, 1930, var. *samanica* Berry, 1932, *idem*, p. 8, text fig. 5.

Planularia magnifica Thalmann, 1933, var. *elongata* Thalmann, 1933, *Eclogae geol. Helvetiae*, vol. 26, p. 255 (for *Cristellaria compressa* H. B. Brady, 1884, not d'Orbigny, 1846, *Challenger Rept., Zoology*, vol. 9, p. 538, pl. 114, figs. 15, 16) is preoccupied by *Planularia elongata* d'Orbigny, 1826, *Annaes sci. nat.*, vol. 7, p. 259, no. 1, and herewith renamed *Planularia magnifica* Thalmann, 1933, var. *falciformis*, nov. var.

Pseudofusulina chihsiaensis (Lee, 1931), var. *regularis* Chen, 1934, *Palaeontologia Sinica*, (B), vol. 4, p. 75, pl. 9, fig. 10, is preoccupied by *P. regularis* (Schellwien, 1898), *Palaeontogr.*, vol. 44, p. 250, pl. 19, figs. 1–6.

Quinqueloculina striatula Cushman, 1932, *U. S. Nat. Mus., Bull.* 161, p. 27, pl. 7, figs. 3, 4, is preoccupied by Deshayes, 1831, *Descript. Coqu. Charact.*, pp. 252, 259, pl. 3, figs. 1, 2.

Reophax scorpiurus Montfort, 1808, var. *testacea* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 89, pl. 8, fig. 100, pl. 9, fig. 101, is preoccupied by *R. difflugiformis* H. B. Brady, 1879, var. *testacea* Flint, 1899, *U. S. Nat. Mus., Rept. for 1897*, p. 273, pl. 16, fig. 1.

Spirillina tuberculata H. B. Brady, 1878, var. *plana* Wiesner, 1931, *Deutsche Südpol.-Exped., Zoology*, vol. 20, p. 128, pl. 21, fig. 252, is preoccupied by *S. plana* von Moeller, 1879, *Acad. Imp. Sci. St. Pétersbourg, Mém.*, sér. 7, vol. 27, no. 5, p. 28, figs. 6, 7.

Textularia tenuissima Earland, 1933, *Discovery Repts.*, vol. 7, p. 95, pl. 3, figs. 21–30 [for *T. elegans* Lacroix, 1932, not *Plecanium (Textularia) elegans* Hantken, 1868, *Inst. Océanogr. Monaco, Bull.* 591, p. 8, text figs. 4, 6 (not fig. 5)] is preoccupied by *T. tenuissima* Häusler, 1881, *Univ. Zürich, Diss.*, p. 40, figured.

Trochammina alternans Earland, 1934, *Discovery Repts.*, vol. 10, p. 103, pl. 3, figs 24–27, is preoccupied by *T. irregularis* (d'Orbigny 1850) var. *alternans* Parker and Jones, 1860, *Geol. Soc. London, Quart. Jour.*, vol. 16, p. 304.

Truncatulina praecincta (Karrer, 1868) var. *depressa* Lipparini, 1932, *Soc. geol. italiana, Boll.*, vol. 51, p. 243, text fig. 2, is preoccupied by *T. depressa* d'Orbigny, 1839, *Voy. Am. Mérid.*, vol. 5, pt. 5, Foram., p. 39, pl. 6, figs. 4–6.

Truncatulina ungeriana (d'Orbigny, 1846) var. *depressa* Lipparini, 1932, *Soc. geol. italiana, Boll.*, vol. 51, p. 243, text fig. 1, is preoccupied by *T. depressa* d'Orbigny, 1839, *Voy. Am. Merid.*, vol. 5, pt. 5, Foram., p. 39, pl. 6, figs. 4–6.

Uvigerina spinicostata Cushman and Jarvis, 1929, var. *alazanensis* Nuttall, 1932, *Jour. Paleontology*, vol. 6, p. 23, pl. 6, fig. 1, is preoccupied by *U. alazanensis* Nuttall, 1932, *idem*, p. 22, pl. 6, fig. 10.

I. BIBLIOGRAPHY

ADAMS, BRADFORD, C., *see* CUSHMAN, J. A., and ADAMS, B. C.

1. ADKINS, W. S., Mesozoic unconformities; Upper Cretaceous unconformities in Texas: *Univ. Texas, Bull.* 3501, pp. 141–149.
2. AGALAROFF, D., DJAFAROFF, DJ., and KHALILOFF, D., Foraminifera of the productive measures of the Apsheron peninsula: *Micro-mineralog. Analysis Azerbaidjan Oil Industry*, No. 7–8, July–August, pp. 19–24, 1 table, 1 text fig. (In Russian.)
3. ALEXANDER, C. I., Stratigraphy of Midway group (Eocene) of southwest Arkansas and northwest Louisiana: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 696–702, 1 text fig.
4. ANDROSOVA, V. P., The microfauna of the North Dwina post-Pliocene (On the history of the North Dwina post-Pliocene): *Inst. Marine Fish. Oceanography, Moscow, Trans.*, vol. 1, pp. 110–132.
5. ANELLI, M., Appunti paleontologici a proposito delle cosidette "argille scagliose": *Riv. italiana paleontologia*, vol. 40, pp. 33–44, pl. 1.

6. ANELLI, M., Sezione geologiche attraverso l'Appennino parmense: *Giorn. Geologia*, vol. 10, pp. 1–27, pl. 1.
7. ANGELINI, G., Distributione geografica dei Clypeasteridae fossili e viventi: *Soc. toscana sci. nat., Atti (Mem.)*, vol. 45, pp. 141–152, 1 text fig.
8. ARNI, PAUL, *Assilina praespira* Douvillé: *Eclogae geol. Helvetiae*, vol. 28, pp. 123–127, pl. 11, 1 text fig.
9. ARNI, PAUL, Über die Stratigraphie des Untereocäns und einige Nummuliten des Ruchbergsandsteins: *Eclogae geol. Helvetiae*, vol. 28, pp. 641–648.
10. ASANO. K., On the fossil Foraminifera ejected with mud from the mud-volcanoes near Kyôsitô, Takao prefecture, Taiwan: *Taiwan Tigaku Kizi*, vol. 4, pp. 101–110. (In Japanese.)
11. ATWILL, E. R., Oligocene Tumey formation of California: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1192–1204, 3 text figs.
12. AUBERT DE LA RÜE, E., La constitution géologique des îles Wallis et Futuna: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 328–330.
13. BAILEY, THOMAS L., Lateral change of fauna in the lower Pleistocene: *Geol. Soc. America, Bull.*, vol. 46, pp. 489–502, pl. 44, 1 text fig.
14. BAILEY, WILLARD F., Micropaleontology and stratigraphy of the lower Pennsylvanian of central Missouri: *Jour. Paleontology*, vol. 9, pp. 483–502, pl. 55, 3 text figs.
15. BAKALOV, F., and TSANKOV, V., Über das Alter der Balkankohle auf Grund der gefundenen Versteinerungen: *Geol. Balkanica*, vol. 1, pp. 85–94, 1 pl.
BARGMANN, H. E., *see* HOARE, C. A., and BARGMANN, H. E.
BAY, HARRY X, *see* GEORGE, W. O., and BAY, H. X.
16. BARRABÉ, LOUIS, and SCHNEEGANS, D., Rapport d'ensemble sur le gisement petrolifère de Gabian (Hérault): *Office nat. combust. liquides, Annales*, pp. 595–662, 819–887, pls. 1–9, 14 text figs.
17. BERMUDEZ, PEDRO J., Foraminíferos de la costa norte de Cuba: *Soc. cubana hist. nat., Mem.*, vol. 9, pp. 129–224, pls. 10–17, 3 text figs.
18. BERTHIAUME, SHERIDAN A., Middle Eocene Foraminifera in western Oregon (abstract): *Geol. Soc. America, Proc. for 1934*, June 1935, p. 393.
19. BERTRAND, LÉON, L'âge oligocène des grès d'Annot: *Soc. géol. France, Compte rendu*, fasc. 15, pp. 229–330.
BIGLER, H., *see* LEUPOLD, W., and BIGLER, H.
20. BIROT, P., Sur l'âge des phases de plissement dans la région méridionale de la série de Pedraforca (Pyrénées catalanes): *Soc. géol. France, Compte rendu*, fasc. 15, pp. 228–229.
21. BLAKE, G. S., *The stratigraphy of Palestine and its building stones*, Printing and Stationary Office, Jerusalem, No. 3, pp. 1–133, 15 text figs.
22. BLANCKENHORN, M., Über die Fauna der syrischen Kreide, des Eozäns und Oligozäns: *Centralbl. Mineralogie, Abt. B*, pp. 148–161.
23. BOGDANOVIC, A., Über *Meandroloculina bogatschovi* n. gen., n. sp., ein neues Foraminifer aus den Miocänschichten Transkaukasiens: *Acad. Sci. U.R.S.S., Bull.*, pp. 691–696, 5 text figs.
24. BOGSCH, L., A nógrádszkáli tufás márga faunájának kora. (Das Alter der Fauna des tuffigen Mergels von Nógrádszakál): *Ungar. Akad. Wiss., Math naturwiss., Anz.*, vol. 53, pp. 719–737.
25. BOGSCH, L., Untersuchung über das Alter der Mediterranfauna von Nógrádszakál, Ungarn: *Centralbl. Mineralogie, Abt. B*, pp. 494–501.
26. BONCEV, EKIM, Über die Stratigraphie der Aptstufe in Nordbulgarien: *Geologia Balkanica*, vol. 1, pp. 57–77, pl. 1, 2 sections, map. (Bulgarian text with German summary).
27. BOULE, MARCELLIN, Types du Prodrôme de paléontologie stratigraphique universelle: *Annales de paléontologie*, vol. 24, pp. 43–52, 3 pls.
28. BOULE, MARCELLIN, and PIVETEAU, JEAN, *Les Fossiles. Éléments de Paléontologie*, Paris (Masson), vii+899 pp., 1330 text figs.
29. BROTZEN, FRITZ, Foraminiferen aus der schwedischen Kreide und ihre Beziehungen zum Sediment und zur Fazies: *Geol. fören. Stockholm, Förh.*, vol. 57, pp. 366–375.
30. BRÜCKL, KARL, Über die Geologie von Badakhshan und Kataghan (Afganistan): *Neues Jahrb., Beilage-Band* 74, *Abt. B*, pp. 360–401, pl. 11, 1 text fig.
31. BRUCKS, E. W., Buckeye field, Matagorda County, Tex.: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 378–400, 4 text figs.
32. BRUGGEN, G. ter, De eocene fyllietformatie in Central-Borneo: *Tech. Hoogeschool Delft, Proefschrift*, Delft, (Waltman), pp. 1–139, 15 text figs., 4 pls., 1 map, sections.
BRUGGEN, G. ter, *see* ZEIJLMANS, C. P. A., and BRUGGEN, G. ter.
33. BUBNOFF, S. von, Wilhelm Deecke †: *Centralbl. Mineralogie, Abt. B*, pp. 264–272.
BUCK, P. DAMIAN, *see* JEANNET, A., LEUPOLD, W., and BUCK, P. D.
34. BULLARD, FRED M., and CUYLER ROBERT H., The upper Pennsylvanian

and Lower Permian section of the Colorado River Valley, Tex.: *Univ. Texas, Bull.* 3501, pp. 191–258, 1 text fig.

35. BURFORD, SELWYN O., Structural features of Brenham Salt Dome, Washington and Austin counties, Tex.: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1330–1338, 2 text figs.
36. BUTLER, A. J., Use of cellulose films in palaeontology: *Nature* (London), vol. 135, p. 510.
37. BUTLER, A. J., Cellulose films in palaeontology: *Mus. Jour.*, vol. 35, no. 3.
38. CALDWELL, F. E. S., A simple method of taking serial sections: *Geol. Mag.*, vol. 72, pp. 521–523, 1 text fig.
39. CAMPBELL, A. S., A few interesting Buliminidae from California and from the South Pacific: *Jour. Entomology and Zoology*, Claremont, Calif., vol. 27, pp. 41–47, 1 pl.
CAMPBELL, A. S., *see* CUSHMAN, J. A., and CAMPBELL, A. S.
40. CARSEY, J. BEN, Unconformities in the Humble White and Baker deep test, Pecos County, Tex.: *Univ. Texas, Bull.* 3501, pp. 127–129.
41. CAYEUX, L., *Les roches sédimentaires de France. Roches carbonatées, calcaires et dolomies*, Paris (Masson), pp. 1–462, 26 pls., 10 text figs.
42. CAYEUX, L., Constitution des phosphates sénoniens de Palestine et de Transjordania: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 1893–1896.
43. CAYEUX, L., Constitution des phosphates sénoniens d'Égypte: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 2134–2137.
44. CHAPMAN, F., Correlations of the Carboniferous and Permian formations of Australia. IV. Note on the correlation of the Carboniferous and Permian rocks of Australia: *Australian and New Zealand Assoc. Adv. Sci., Melbourne Meeting, Rept.*, p. 460.
45. CHAPMAN, F., and CRESPIN, IRENE, The sequence and age of the Tertiaries of southern Australia: *Australian and New Zealand Assoc. Adv. Sci., Melbourne Meeting, Rept.*, pp. 118–126.
46. CHAPMAN, F., and CRESPIN, IRENE, Foraminiferal limestone of Eocene age from the Northwest Division, Western Australia: *Royal Soc. Victoria, Proc.*, vol. 48, new ser., pp. 55–62, pls. 3, 4.

46a. CHAPMAN, F., and PARR, WALTER J., Foraminifera and Ostracoda from soundings made by the trawler "Bonthorpe" in the Great Australian Bight: *Royal Soc. Western Australia, Jour.*, vol. 21, pp. 1–7, pl. 1.
CHAPMAN, F., *see* MAWSON, D., and CHAPMAN, F.

47. CHAPUT, E., L'éocène de plateau de Galatie (Anatolie centrale): *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 767, 768.
48. CHEN, S., The divisions of the Yangsin limestone in southeastern Hupeh: *Geol. Soc. China, Bull.*, vol. 14, pp. 63–65, 2 text figs.
49. CHENEY, M. G., Late Paleozoic unconformities in north-central Texas: *Univ. Texas, Bull.* 3501, pp. 123–126.
50. CODARCEA, AL., Sur la présence du Crétacé supérieur à Valeapai (district de Caras): *Soc. Romîne géol., Bull.*, vol. 2, pp. 37–40, 1 pl.
51. CODARCEA, AL., Considérations tectoniques générales resultant d'un nouvel examen de la coupe des Portes de Fer (Varciorova): *Inst. géol. Roumanie, Comptes rendus*, vol. 22, reprint 11 pp., 4 text figs., 1 pl.
52. COLOM CASASNOVAS, G., Las especies de la familia "*Peneroplidae*" actuales y fósiles de las Baleares: *Soc. española historia nat., Bol.*, vol. 35, pp. 83–102, pls. 8–14, 5 text figs.
53. COLOM CASASNOVAS, G., Notes sobre foraminífers: *Inst. catalana hist. nat., Bull.*, vol. 35, pp. 1–12, pls. 6, 7, 5 text figs.
54. COMBIER, M., Carte géologique de Dakar: *Com. études hist. sci. Afrique occident. franç., Pub.* (B), no. 1, Paris (Larose), pp. 1–39, 6 pls., 1 map.
55. CONDIT, D. DALE, Oil possibilities in Northwest district, Western Australia: *Econ. Geology*, vol. 30, pp. 860–878.
56. COOKE, C. WYTHE, Notes on the Vicksburg group: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1162–1172.
57. CORNELIUS, H. P., Geologie der Err-Julier-Gruppe. I. Teil. Das Baumaterial (Stratigraphie und Petrographie, exkl. Quartär): *Geol. Karte Schweiz, Beitr.*, N. F., vol. 70, xxiii+321 pp., 3 pls., 22 text figs, 1 table.
58. CORTINI, I. R., Algunas ideas para la manipulación de foraminíferos: *Est. ciencias nat., Rec. Contr.*, vol. 1, pp. 22–27, 2 pls., 2 text figs.
59. COULSON, A., Geological notes on Lake Connewarre, near Gelong: *Royal Soc. Victoria, Proc.*, vol. 48, pp. 1–10, 1 pl.
CRESPIN, IRENE, *see* CHAPMAN, F., and CRESPIN, I.
60. CUSHMAN, JOSEPH A., Upper Eocene Foraminifera of the southeastern United States: *U. S. Geol. Survey, Prof. Paper* 181, 88 pp., 23 pls.
61. CUSHMAN, JOSEPH A., Paleozoic Foraminifera, their relationships to modern faunas and to their environment: *Jour. Paleontology*, vol. 9, pp. 284–287.
62. CUSHMAN, JOSEPH A., Reports on the collections obtained by the First John-

son-Smithsonian Deep-Sea Expedition to the Puerto Rican Deep; Fourteen new species of Foraminifera: *Smithsonian Misc. Coll.*, vol. 91, no. 21, Pub. 3327, pp. 1–9, pls. 1–3.

63. CUSHMAN, JOSEPH A., *Bitubulogenerina howei*, a new species from the lower Oligocene: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 20, 21, pl. 3.
64. CUSHMAN, JOSEPH A., New species of Foraminifera from the lower Oligocene of Mississippi: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 25–39, pls. 4, 5.
65. CUSHMAN, JOSEPH A., Some new Foraminifera from the Late Tertiary of Georges Bank: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 77–83, pl. 12.
66. CUSHMAN, JOSEPH A., Notes on some American Cretaceous flabellinas: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 83–89, pl. 13.
67. CUSHMAN, JOSEPH A., Index to volumes 6–10: *Cushman Lab. Foram. Research, Contr.*, pp. 1–20.
68. CUSHMAN, JOSEPH A., and ADAMS, BRADFORD C., New Late Tertiary bolivinas from California: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 16–20, pl. 3.
69. CUSHMAN, JOSEPH A., and CAMPBELL, A. S., Cretaceous Foraminifera from the Moreno shale of California: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 65–73, pls. 10, 11.
70. CUSHMAN, JOSEPH A., and HEDBERG, HOLLIS D., A new genus of Foraminifera from the Miocene of Venezuela: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 13–16, pl. 3.
71. CUSHMAN, JOSEPH A., and HOBSON, H. D. J., A foraminiferal faunule from the type San Lorenzo formation, Santa Cruz County, Calif.: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 53–64, pls. 8, 9.
72. CUSHMAN, JOSEPH A., and MARTIN, LOIS T., A new genus of Foraminifera, *Discorbinella*, from Monterey Bay, Calif.: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 89, 90, pl. 14.
73. CUSHMAN, JOSEPH A., and PARKER, FRANCES L., Some American Cretaceous buliminas: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 96–101, pl. 14.
74. CUSHMAN, JOSEPH A., and SIEGFUS, STANLEY S., New species of Foraminifera from the Kreyenhagen shale of Fresno County, Calif.: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 90–95, pl. 14.
75. CUVILLIER, JEAN, Repartition et valeur stratigraphique de *Nummulites uroniensis* A. Heim (de la Harpe) en Égypte et dans le bassin méditerranéen: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 483–485.
76. CUVILLIER, JEAN, Découverte de *Nummulites laevigatus* Lmk. sur la plage d'Audresselles (Pas-de-Calais): *Soc. géol. France, Comptes rendu*, p. 18.
CUVILLIER, JEAN, *see* DONCIEUX, L., and CUVILLIER, J.
CUYLER, ROBERT H., *see* BULLARD, F. M., and CUYLER, R. H.
77. DANGEARD, L., Sur les roches oolithiques situées à la base des "sables de Glos": *Soc. linnéenne Normandie, Bull.*, 8th ser., vol. 7, pp. (38)–(42).
78. DANGEARD, L., Les pisolites à Girvanelles dans le Jurassique de Normandie: *Soc. géol. France, Bull.*, 5th ser., vol. 5, pp. 263–276, 3 pls.
79. DAVIES, A. MORLEY, Tertiary Faunas; A text-book for oil-field palaeontologists and students of geology. Vol. I, The composition of Tertiary faunas, London (Murby), xii+406 pp., 565 text figs. (*Foraminifera:* pp. 1–63, 106 text figs.)
80. DEB, S., Sur la découverte d'une orbitoide dans les grès d'Annot et sur ses conséquences: *Acad. sci. Paris, Comptes rendus*, vol. 201, pp. 841–843.
81. DEB, S., Sur la découverte de *Nummulites* dans les grès nummulitiques des Alpes-Maritimes et sur l'origine de cette série de couches: *Acad. sci. Paris, Comptes rendus*, vol. 201, pp. 973–975.
82. DEDEM, G. W. BARON VAN, Der geologische Aufbau der Sierra Tejeda (Provinz Malaga und Granada): *Assoc. Étude géol. Méditerran. occident.*, Géologie des chaînes bétiques et subbétiques, vol. 4, no. 7, pt. 2, pp. 1–9, 1 pl. (map).
83. DEFLANDRE, G., Technique micropaléontologique appliquée à l'étude des silex: *Soc. franç. microscopie, Bull.*, vol. 4, pp. 104–111.
84. DEFLANDRE, G., "Revue": *Soc. franç. microscopie, Bull.*, vol. 4, pp. 116–120, 3 text figs.
85. DEFLANDRE, G., Considérations biologiques sur les micro-organismes d'origine planctonique conservés dans les silex de la craie: *Biol. France-Belgique, Bull.*, vol. 69, pp. 213–244, 5 pls., 11 figs.
86. DEFLANDRE, G., Présence de microdiaclases dans les éclats de silex. Leur importance dans les colorations artificielles des microfossiles et en particulier des foraminifères: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 953–955.
87. DERVILLE, P. H., Observations et réflexions sur le genre *Nubecularia: Soc. géol. France, Bull.*, 5th ser., vol. 5, pp. 621–628, pl. 29.

88. DEUSSEN, ALEXANDER, Thirty-five years of progress in the knowledge of the geology of Texas: *Univ. Texas, Bull.* 3501, pp. 37–57.
89. DIETRICH, W. O., Zur Stratigraphie der kolumbianischen Ostkordillere: *Centralbl. Mineralogie, Abt. B*, pp. 74–82, 10 text figs.
90. DIETRICH, W. O., Anhang: Fam. Nummulinidae. *See* KREJCI-GRAF, K., and LIEBUS, A.
DJAFAROFF, DJ., *see* AGALAROFF, D., DJAFAROFF, DJ., and KHALIKOFF, D.
91. DONCIEUX, L., and CUVILLIER, J., Les foraminifères du Lutétien inférieur dans le sud du désert arabique: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 1873–1875.
DONCIEUX, L., *see* FALLOT, P., and DONCIEUX, L.
92. DONS, C., *Echinofolliculina mortensi* n. gen., n. sp.: *K. norske vidensk. Selsk. Trondhjem*, vol. 7, pp. 28–30, 2 figs. (*Non vidi*).
93. DONS, C., Übersicht der Folliculiniden: *K. norske vidensk. Selsk. Trondhjem*, vol. 7, pp. 31, 32. (*Non vidi*).
94. DOYLE, W. L., Distribution of mitochondria in the foraminiferan *Iridia diaphana: Science*, new. ser., vol. 81, p. 387.
95. DUBERTRET, L., Premières recherches sur les hydrocarbures minéraux dans les états du Levant sous mandat français: *Office nat. combust. liquides, Annales*, no. 5, *1934*, pp. 877–899, and no. 1, *1935*, pp. 31–54, 4 pls.
96. DUNBAR, CARL O., SKINNER, JOHN W., and KING, ROBERT E., Dimorphism in Permian fusulines (abstract): *Geol. Soc. America, Proc. for 1934*, June 1935, p. 368.
97. DUNBAR, CARL O., SKINNER, JOHN W., and KING, ROBERT E., Dimorphism in Permian fusulines: *Univ. Texas, Bull.* 3501, pp. 173–190, pls. 1–3, 1 text fig.
DUNN, P. H., *see* HOWELL, B. F., and DUNN, P. H.
EASTON, H. D. JR., *see* STAMEY, R. A., EASTON, H. D. JR., and MONTGOMERY, J. C.
98. EHRMANN, FRANCE, and FLANDRIN, JACQUES, Au sujet des grandes Lépidocyclines de l'Éocène des Beni-Afeur (S. de Taher, département de Constantine): *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 152–154.
99. EICHENBERG, W., Characterization of lower chalk strata by means of microfauna: *Inst. Petroleum Technologists, Jour.*, vol. 21 (142), p. 288 A.
100. EICHENBERG, W., Die Erforschung der Mikroorganismen, insbesondere der Foraminiferen, der norddeutschen Erdölfelder. Teil. I, 4. Folge: Foraminiferen aus dem Apt von Wenden am Mittellandkanal: *Niedersächsische geol. Ver., 27. Jahresb.*, and *Roemer-Mus. Hildesheim, Mitt.*, no. 37, pp. 1–40, 7 pls.
101. EICHENBERG, W., Mikrofaunen-Tafeln zur Bestimmung von Unterkreide-Horizonten in Bohrkernen norddeutscher Oelfelder: *Oel und Kohle*, vol. 11, no. 23, pp. 388–398, 14 pls.
102. EISENACK, ALFRED, Mikrofossilien aus Doggergeschieben Ostpreussens: *Zeitschr. Geschiebeforschung*, vol. 11, pp. 167–184, pls. 4, 5, 9 text figs.
103. EKMAN, SVEN, *Tiergeographie des Meeres*, Leipzig (Akademische Verlagsges), xii +542 pp., 244 text figs.
104. ELLIS, BROOKS F., Illustrated catalogue of Foraminifera (abstract): *Geol. Soc. America, Proc. for 1934*, June 1935, p. 369.
105. FABIAN, HANS-JOACHIM, Sedimentpetrographische Bemerkung über Sedimente des oberen Jura von Olomucany bei Brünn: *Firgenwald*, vol. 8, pp. 84–86.
106. FAHRION, HELMUT, Die Mikrofauna des unteren Doggers in Schwaben: *Univ. Tübingen, Inaug.-Diss.*, pp. 1–35.
107. FALLOT, PAUL, and DONCIEUX, LOUIS, L'âge du flysch de la périphérie de la chaîne calcaire du Rif: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 76–78, 1 text fig.
108. FAURÉ-FREMIET, E., L'oeuvre de Felix Dujardin et la notion du protoplasma: *Protoplasma* (Leipzig), vol. 23, pp. 250–269.
109. FENTON, CARROL LANE, *Along the Hill*, A John Day Book in association with Reynal and Hitchcook, 96 pp.
110. FENTON, M. A., Nitrocellulose sections of fossils and rocks: *Am. Midland Naturalist*, vol. 16, pp. 410–412, 1 text fig.
111. FLANDRIN, JACQUES, Quelques traits de la paléogéographie algérienne à l'Éocène moyen: *Acad. sci. Paris, Comptes rendus*, vol. 201, pp. 403–405.
FLANDRIN, JACQUES, *see* EHRMANN, F., and FLANDRIN, J.
112. FLORIDA, G. B., Sul rinvenimento di orbitoidi non rimaneggiate nel flysch lombardo: *Soc. geol. italiana, Boll.*, vol. 54, pp. 254–262, pl. 14, 2 text figs.
113. FLORIDA, G. B., Contributo alla conoscenza stratigrafica del Néogene della Cirenaica: *Soc. italiana sci. nat., Atti*, vol. 74, pp. 19–42.
114. FRANKE, ADOLF, Ein einfacher Auslesetisch für Mikrofossilien: *Senckenbergiana*, vol. 17, pp. 87–89, 3 text figs.
115. FRANKE, ADOLF, Sammeln, Präparieren und Aufbewahrung von Mikrofossilien: *Senckenbergiana*, vol. 17, pp. 124–137, 6 text figs.

116. FRASER, F. J., MCLEARN, F. H., RUSSELL, L. S., WARREN, P. S., and WICKENDEN, R. T. D., Geology of southern Saskatchewan: *Canada Geol. Survey, Mem.* 176, 137 pp., 5 pls., 4 text figs., 2 maps.

117. FRENGUELLI, JOAQUIN, *Silicotextulina deflandrei*, nueva especie de foraminífero silíceo viviente en el puerto de San Blas (privincia de Buenos Aires): *Inst. Mus. Univ. nac. de la Plata, Notas del Museo de la Plata, Zoology*, vol. 1, no. 1, pp. 113–119, 1 text fig.

118. FRIZZELL, DON L., and WHEELER, HARRY E., Neotypes in zoological nomenclature: *Jour. Paleontology*, vol. 9, pp. 453, 454.

119. FUJIMOTO, H., A new locality of Fusulina limestone in northern Kyushu: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 36–38, 1 pl. (In Japanese).

120. FURON, RAYMOND, Le crétacé supérieur de l'ouest africain (Gabon et Soudan): *Soc. géol. France, Compte rendu*, pp. 23, 24.

121. FURON, RAYMOND, A propos de la géologie de la Mauritanie: *Soc. géol. France, Compte rendu*, p. 155.

122. FURON, RAYMOND, Le crétacé et le tertiaire du Sahara soudanais (Soudan, Niger, Tchad), avec préface de M. PAUL LEMOINE: *Mus. nat. histoire nat., Arch.*, vol. 13, pp. 1–98, 7 pls., 19 text figs.

GARRETT, J. B. JR., *see* MORNHINVEG, A. R., and GARRETT, J. B. JR.

123. GAUTHIER-LIÉVRE, L., Sur une des singularités de l'Oued Rhir: Des Foraminifères thalassoides vivants dans les eaux shariennes: *Soc. hist. nat. Afrique du Nord, Bull.*, vol. 26, pp. 142–147, pl. 12, 1 text fig.

124. GEORGE, WILLIAM O., and BAY, HARRY X, Subsurface data on Covington County, Miss.: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1148–1161, 1 text fig.

125. GERTH, H., The distribution and evolution of the larger Foraminifera in the Tertiary sediments: *K. Akad. Wetensch. Amsterdam, Proc.*, vol. 38, pp. 455–461, 1 table.

126. GERTH, H., De verspreiding en evolutie der groote Foraminifera in de tertiaire afzettingen: *K. Akad. Wetensch. Amsterdam, Versl. afd. Natuurk.*, vol. 44, p. 34.

127. GEYN, WILHELMINA A. E. VAN DE, and VLERK, I. M. VAN DER, A monograph on the Orbitoididae occurring in the Tertiary of America, compiled in connection with an examination of a collection of larger Foraminifera from Trinidad: *Leidsche geol. Mededeel.*, vol. 7, pp. 221–272, 99 text figs., 2 maps.

128. GOCEV, P., Versuch einer Parallelisierung des Paläogens der Balkanländer: *Bulgarische Geol. Gesell., Zeitschr.*, vol. 7, pp. 24–49, 4 pls., 3 text figs. (Bulgarian with summary in German.)

129. GRAVELL, DONALD W., and HANNA, MARCUS A., Larger Foraminifera from the Moody's Branch marl, Jackson Eocene, of Texas, Louisiana and Mississippi: *Jour. Paleontology*, vol. 9, pp. 327–340, pls. 29–32, 1 text fig.

130. GREIG, D. A., *Rotalia viennoti*, an important foraminiferal species from Asia Minor and western Asia: *Jour. Paleontology*, vol. 9, pp. 523–526, pl. 58.

GRY, HELGE, *see* MADSEN, V., ØDUM, H., and GRY, H.

131. GUBLER, JEAN, Les Fusulinidés du Permien de l'Indochine. Leur structure et leur classification: *Soc. géol. France, Mém.*, new ser., vol. 11, no. 26, pp.1–173, pls. 1–8, 54 text figs.

132. HAANSTRA, U., Geologie von Ost-Ibiza (Balearen): *Univ. Utrecht, Diss.* (Proefschrift), pp. 1–62, pls. 1–3, sections, map, 1 text fig. (Also printed in: *Géol. Méditerranée occident.*)

133. HADLEY, WADE H., JR., Seven new species of Foraminifera from the Tertiary of the Gulf Coast: *Bull. Am. Paleontology*, vol. 22, no. 74, pp. 187–195, pl. 1.

HAHN, E., *see* WANNER, J., and HAHN, E.

134. HALBOUTY, M. T., Geology and geophysics of southeast flank of Jennings Dome, Acadia Parish, La., with special reference to overhang: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1308–1329, 9 text figs.

135. HALET, F., Sur un niveau à *Nummulites planulatus* du Mont Panisel (Mons): *Soc. belge géologie, Bull.*, vol. 45, pp. 160–162, 1 text fig.

HANNA, MARCUS A., *see* GRAVELL, D.W., and HANNA, M. A.

136. HANZAWA, SHOSHIRO, Discovery of *Lepidocyclina* from near Sendai: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 533, 534.

137. HANZAWA, SHOSHIRO, Topography and geology of the Riukiu Islands: *Tohoku Imp. Univ., Sci. Repts.*, 2d ser., vol. 17, pp. 1–61, pls. 1–15, 7 text figs., 1 chart, 5 geol. maps.

138. HANZAWA, SHOSHIRO, Some fossil *Operculina* and *Miogypsina* from Japan and their stratigraphical significance: *Tohoku Imp. Univ., Sci. Repts.*, 2d ser., vol. 18, pp. 1–29, pls. 1–3.

139. HANZAWA, SHOSHIRO, Geological history of the Ryukyu Islands: *Imp. Acad. Sci. Japan, Proc.*, vol. 11, pp. 58–61.

140. HANZAWA, SHOSHIRO, Study of fossils in ultraviolet ray: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 733–735, 1 text fig. (In Japanese.)

HANZAWA, SHOSHIRO, *see* YABE, H., and HANZAWA, S.

141. HATAE, NOBUSHIRO, The foraminiferal fauna in the limestones of the Heian system in the vicinity of Neietsu, Kogen-do: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 362, 363. (In Japanese).
142. HAYASAKA, I., A *Discocyclina*-limestone exposed near the Peak of Minami-Daibu in Takao prefecture, Taiwan: *Imp. Acad. Japan, Proc.*, vol. 11, pp. 329, 330, 2 text figs.
143. HECHT, FRANZ E., Foraminifera unterm Foto-Objektiv: *Natur u. Volk*, vol. 55, pp. 295–303, 8 text figs.
HEDBERG, HOLLIS D., *see* CUSHMAN, J. A., and HEDBERG, H. D.
HEDBERG, HOLLIS D., *see* SCHENCK, H. G., and HEDBERG, H. D.
144. HEMMER, A., Geología de los terrenos petrolíferos de Magellanes y las exploraciones realizadas: *Soc. nac. mineria, (Chile), Bol. minero*, vol. 47, pp. 139–149, 181–188, 2 pls., 1 map.
145. HENBEST, LLOYD G., *Nanicella*, a new genus of Devonian Foraminifera: *Washington Acad. Sci., Jour.*, vol. 25, pp. 34, 35.
146. HENDERSON, I. J., The lower Lias at Hock Cliff, Tretherne: *Bristol Nat. Soc., Proc.*, 4th ser., vol. 7, pp. 549–564, 6 text figs.
147. HERON-ALLEN, EDWARD, A postscript upon the "Origin (and development) of species": *Nature* (London), vol. 136, pp. 132, 133.
148. HERON-ALLEN, EDWARD, Dementia nomenclatorica americana: *Nature* (London), vol. 136, p. 797.
149. HETZEL, W. H., Enkele kritische aanteekeningen bij een recente publicatie over de geologie van den oostarm van Celebes: *De Ing. in Nederlandsch-Indië, Mijnbouw en Geol.*, vol. 2, pt. 4, pp. 29–31.
150. HETZEL, W. H., Toelichting bij blad 54 (Madjenang), Geologische Kaart van Java, schaal 1: 100,000: *Nederlandsch-Indië, Dienst Mijnbouw*, pp. 1–53, 7 pls., 1 text fig.
151. HILLS, JOHN M., The insoluble residues of the Cambro-Ordovician limestones of the Lehigh Valley, Pa.: *Jour. Sedimentary Petrology*, vol. 5, pp. 123–132, 3 text figs.
152. HOARE, CECIL A., and BARGMANN, H. E., Zoological Record, vol. 71, *1934*, II. Protozoa: *Zool. Soc. London*, September, 1935, pp. 1–71.
HOBSON, H. D., *see* CUSHMAN, J. A., and HOBSON, H. D.
153. HOFFHERR, RENÉ, and MAUCHAUSSÉ P., Charbon et pétrole en Afrique du Nord. (Avec collaboration DE PINEAU MIGAUX, DE CIZANCOURT, CLARIOND, LACOSTE, DRESCH et BOUSSER): *Soc. études économ. statist. Maroc*, (Felix Alcan, Paris), 316 pp., 20 pls. (Foraminifera determined by LACOSTE.)
HORNBERGER, JOSEPH, *see* PLUMMER, F. B., and HORNBERGER, J.
154. HOWCHIN, W., Notes on the geological sections obtained by several borings situated on the plain between Adelaide and Gulf St. Vincent. Part 1.: *Royal Soc. South Australia, Trans.*, vol. 59, pp. 68–102.
155. HOWE, HENRY V., and MCGUIRT, JAMES H., Salt dome of Cameron and Vermilion parishes: *Louisiana Dept. Cons., Geol. Bull.* 6, pp. 73–166, pls. 4, 8, 9, 16 text figs.
156. HOWELL, B. F., and DUNN, P. H., Early Cambrian Foraminifera from Greenland and Labrador (abstract): *Geol. Soc. America, Proc. for 1934*, June, 1935, pp. 350, 351.
157. HUDIMOTO, H., A new locality of Fusulina-limestone in northern Kyûssyû: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 36–38, 1 pl. (In Japanese.)
158. ILIE, MIRCEA, Observations microscopiques sur le mésozoique des monts Trascau et du bassin de l'Aries: *Inst. géol. Roumanie, Comptes rendus*, vol. 20, pp. 134–136.
159. IMAMURA, S., Some new facts concerning the Yatuo series: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 532, 533. (In Japanese.)
160. ISRAELSKY, MERLE C., Tentative foraminiferal zonation of subsurface Claiborne of Texas and Louisiana: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 689–695, 5 text figs.
161. ISRAELSKY, MERLE C., Review of "Guide-book of the eleventh annual field trip of the Shreveport Geological Society in southeast Mississippi, compiled by ROY T. HAZZARD and B. W. BLANPIED": *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 571–575, 2 tables.
162. JAWORSKI, E., Neue Literatur. b. Paläontologisch, 3. Foraminifera: *Zeitschr. Induktive Abstammungs-u. Vererbungslehre*, vol. 69, pp. (18)–(23).
163. JEANNET, A., Compte rendu de l'excursion (de la Société géologique suisse dans les Alpes de Schwytz (Mythen-Iberg-Sihltal)): *Eclogae geol. Helvetiae*, vol. 28, pp. 629–640, pls. 19, 20.
164. JEANNET, A., LEUPOLD, W., and BUCK, P. DAMIAN, Stratigraphische Profile des Nummulitikums von Einsiedelen-Iberg: *Schweizer naturf. Gesell., Ber.*, vol. 1, (1932–1935), pp. 35–51, pls. 1, 2.
165. JEDLITSCHKA, HEINRICH, Revision der

Foraminiferen Gattungen *Siphonodosaria, Nodogenerina, Sagrinnodosaria: Naturf. Ver. Brünn, Verh.*, Jahrg. 66, pp. 61–72, 3 text figs.

166. JEDLITSCHKA, HEINRICH, Beitrag zur Kenntnis der Mikrofauna der subbeskidischen Schichten: *Naturwiss. Ver. Troppau, Č.S.R., Mitt.*, pp. 1–18, 19 text figs.
167. JOHNSON, JEAN C., *Microscopic objects: how to mount them*, London (The English Universities Press Ltd.), viii+144 pp., 9 pls.
168. JOLEAUD, L., L'hypothèse de la "mer saharienne" et la découverte de foraminifères thalassoïdes dans les eaux de l'oued Rir (Sahara constantinois): *La Nature* (Paris), no. 2967, pp. 549–554.
169. KEIJZER, CHRISTIAAN, JACOBS, On variability in East Indian Foraminifera: *Univ. Leiden, Dissert.*, also printed in *Temminckia*, vol. 1, pp. 75–154, pls. 4–6, 29 text figs.

KHALILOFF, D., *see* AGALAROFF, D., DJAFAROFF. DJ., and KHALILOFF, D.

170. KING, PHILIP B., Unconformities in the later Paleozoic of Trans-Pecos Texas: *Univ. Texas, Bull.* 3501, pp. 131–137.

KIREEWA, GALINA, *see* RAUSER-ČERNOUSSOVA, D., and KIREEWA, G.

171. KLEINPELL, ROBERT M., Proposed biostratigraphic classification of California Miocene (abstract): *Geol. Soc. America, Proc. for 1934*, June 1935, pp. 390, 391.
172. KLINGHARDT, FRANZ, Die Kreide-Tertiär-Grenze und verwandte Fragen: *Deutsche geol. Gesell., Zeitschr.*, vol. 87, pp. 22–29, and p. 61, pls. 1–6, 1 table.
173. KOBAYASHI, T., Contribution to the Jurassic Torinosu series of Japan: *Japanese Jour. Geology and Geography*, vol. 12, pp. 69–71, 2 pls.
174. KOCH, LAUGE, Geologie von Grönland: *Geologie d. Erde* (Borntraeger), Berlin, 159 pp., 12 text figs.
175. KOCH, RICHARD E., Namensänderung einiger Tertiär-Foraminiferen aus Niederländisch Ost-Indien: *Eclog. geol. Helvetiae*, vol. 28, pp. 557, 558.
176. KODYM, O., and MATĚJKA, A., Zpráva o geologii flyše mezi Uherskym Ostrohem a Bojkovicemi na Moravé (Note sur la géologie du flysch dans la région entre Uhersky Ostroh et Bojkovice en Moravie): *Stat. geol. ust. C.S.R., Vest.* vol. 11, pp. 41–54, 1 pl., 1 map. (Czechoslovakian with summary in French.)
177. KRAFFT, GEORG, Wilhelm Deecke zum Gedächtnis: *Badische Fundber.*, vol. 3, pp. 177–181.
178. KRAJEWSKI, St., Prof. Tadeusz Wisniowski (1865–1933): *Service géol. Pologne, Bull.*, vol. 8, 1st ser., pp. 16–28.
179. KRAUS, ERNST, Über den ultrahelvetischen Kreideflysch: *Eclog. geol. Helvetiae*, vol. 28, pp. 45–50.
180. KRÄUTNER, THEODOR, Ein Senonvorkommen bei Săcel in der Marmarosch: *Siebenbürg. Ver. Naturwiss, Verh. u. Mitt.*, vol. 83–85 (*1933–34*), 1935, pp. 34–41, 1 pl.
181. KREJCI-GRAF, KARL, and LIEBUS, ADALBERT, Tertiäre Foraminiferen aus den rumänischen Ölgebieten (mit einem Beitrag von W. O. DIETRICH): *Neues Jahrb., Beilage-Band 74, Abt. B*, pp. 118–156, pl. 3, 2 text figs.
182. KUFFERATH, H., A propos des méthodes de recherche des microfossiles: *2. Congress nat. sci. Bruxelles*, pp. 749–752.
183. KUHN, OSKAR, Revision der Opalinus-Ton (-Dogger Alpha-)-Fauna in Franken mit Ausschluss der Cephalopoden: *Palaeont. Zeitschr.*, vol. 17, pp. 109–158, pls. 8–10.
184. KUHN, OSKAR, Die Fauna des untersten Lias Delta (*Gibbosus*-Zone) aus dem Sendelbach im Hauptsmoorwald östlich Bamberg: *Neues Jahrb., Beilage-Band 73, Abt. B*, pp. 465–493, pl. 18.
185. KUHN, OSKAR, Kurze Übersicht über die Stratigraphie und Fauna des fränkischen Calloviums: *Centralbl. Mineralogie, Abt. B*, pp. 311–319.
186. LABORATORY, N. V. DE BATTAFSCHE PETROLEUM MAATSCHAPPIJ: Recovery of Foraminifera by means of flotation: *Jour. Paleontology*, vol. 9, pp. 745, 746.
187. LACOSTE, JEAN, L'âge de la série du Flysch rifain en zone française: *Soc. géol. France, Compte rendu*, pp. 73, 74.
188. LACOSTE, JEAN, Les foraminifères microscopiques, Quelques considérations sur leur utilisation en géologie: *Mus. nat. histoire nat., Arch.*, 6th ser., vol. 12, pp. 197–200.
189. LACROIX, EUGENE, *Discammina fallax* et *Haplophragmium emaciatum: Inst. Océanographie Monaco, Bull.* 667, pp. 1–16, 9 text figs.
190. LAFFITTE, ROBERT, Le Danien et le Nummulitique dans l'Aurès occidental: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 1497–1499.
191. LALICKER, CECIL A., Two new Foraminifera of the genus *Textularia: Smithsonian Misc. Coll.*, vol. 91, no. 22, pp. 1, 2, pl. 1.
192. LALICKER, CECIL A., New Cretaceous Textulariidae: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 1–13, pls. 1, 2.
193. LALICKER, CECIL A., New Tertiary Textulariidae: *Cushman Lab. Foram. Research, Contr.*, vol. 11, pp. 39–51, pls. 6, 7.
194. LAPPARENT, ALBERT F. DE, La transgression nummulitique dans les Alpes de

Provence: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 157–159.

195. LAPPARENT, JACQUES DE, La structure des monts et la position tectonique des bauxites aux flancs du Parnasse (Grèce): *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 161–163.
196. LAPPARENT, JACQUES DE, Sur la composition lithologique du Biancone: *Soc. géol. France, Compte rendu*, pp. 43, 44.
197. LECALVEZ, JEAN, Les gamètes de quelques foraminifères: *Acad. sci. Paris, Comptes rendus*, vol. 201, pp. 1505–1507, 3 text figs.
198. LECALVEZ, JEAN, Sur quelques foraminiféres de Villefranche et de Banyules: *Arch. Zool. éxpér. et gén., Notes et Rev.*, vol. 77, no. 2, pp. 79–98, 11 text figs.
199. LEHNER, E., Introduction á la géologie de Trinidad et bibliographie géologique. (Documentation géologique sur les pays pétrolifères de l'Amérique du Sud et des Îles de l'archipel des Caraïbes, fasc. 1): *Office nat. combust. liquides, Annales*, pp. 691–730, 2 pls.
200. LEHNER, E., Report on the possibilities of establishing an artesian water supply for the Island of Carriacou, with appended notes on the general geology of Carriacou: *St. Georges, Grenada*, (Government's Printing Office), pp. 1–6, 1 map.
201. LEHNER, LEONHARD, Über das Turon auf dem fränkischen Jura. Studien über die fränkische albüberdeckende Kreide VIII. (Herausgegeben von RICHARD DEHM): *Centralbl. Mineralogie, Abt. B*, pp. 423–438.
202. LERICHE, M., Les *Nummulites* remaniées dans les formations récentes de la côte flamande: *Soc. géol. Belgique, Annales*, vol. 58, pp. 173–182, 2 text figs.
203. LEUPOLD, W., Note sur quelques échantillons du nummulitique de la région Zunuz-Harzand, Appendix I to: H. RIEBEN (*see* no. 260 below): *Soc. neuchâteloise sci. nat., Bull.*, vol. 59, *1934*, 1935, pp. 136–139.
204. LEUPOLD, W., and BIGLER, H., *Coscinoconus*, eine neue Foraminiferenform aus Tithon-Unterkreide-Gesteinen der helvetischen Zone der Alpen: *Eclog. geol. Helvetiae*, vol. 28, pp. 606–624, pl. 18.
205. LEUPOLD, W., and MAYNC, W., Das Auftreten von *Choffatella, Pseudocyclammina, Lovcénipora* (*Cladocoropsis*) und *Clypeina* im alpinen Faziesgebiet: *Eclog. geol. Helvetiae*, vol. 28, pp. 129–139, 3 text figs.

LEUPOLD, W., *see* JEANNET, A., LEUPOLD, W., and BUCK, P. D.

LIEBUS, ADALBERT, *see* KREJCI-GRAF, K., and LIEBUS, A.

206. LIJN, P. VAN DER, Nederland's zwerfsteenen: *Zutphen* (Thieme), xvi+150 pp. figs. (*Non vidi.*)
207. LIKHAREV, B., On Prof. Schuchert's paper on the correlation of some of the most important sections of the marine Permian: *Soviet Geology, Problems*, vol. 5, pp. 672–679. (Russian with summary in English.)
208. LIPKIVSKA, G. V., Report on the fauna in banded clays: *Allukrainian Acad. Sci., Jour. Geology*, vol. 2, p. 139. (In Ukranian.)
209. LUNDGREN, A., Die stratigraphischen Ergebnisse der Tiefbohrung bei Kullemölla im südöstlichen Schonen: *Sveriges geol. undersökning*, ser. C, Arsb. 29, no. 386. (*Non vidi*).
210. MACAROVICI, N. G., and VĂSCĂUTANU, THÉODORE, Le sondage de Socola (Jassy) en 1927. (Faune des foraminifères); première note: *Annales Sci. Univ. Jassy*, vol. 20, pp. 415–421.
211. MACFADYEN, W. A., Mesozoic Palaeontology, Jurassic Foraminifera: *Geol. and Palaeont. British Somaliland*, pt. 2, (London), pp. 7–20, pl. 1.
212. MACFADYEN, W. A., Cretaceous Foraminifera of the genus *Orbitolina: Geol. and Palaeont. British Somaliland*, pt. 2, (London), pp. 21, 22, 1 pl.
213. MADSEN, VICTOR, ØDUM, HILMAR, and GRY, HELGE, Boringerne ved Langbrogaard ved Sønderborg: *Danmarks geol. undersøgelse*, 2d ser., no. 55, pp. 1–47, 1 map (pp. 14–18: Foraminifera determined by H. ØDUM).
214. MARCHETTI, M., Breve guide alle escursioni geologiche in Cirenaica. XIII. Gli affioramenti cretacei della Cirenaica: *Soc. geol. italiana, Boll.*, vol. 54, pp. lxxxv–lxxxviii, text fig. 16.
215. MARCHETTI, M., Breve guide alle escursioni geologiche in Cirenaica XXI. Cascata dell' U. Derna (Scelleal.): *Soc. geol. italiana, Boll.*, vol. 54, p. cxiv, text fig. 26.
216. MARCHETTI, M., Breve guide alle escursioni geologiche in Cirenaica. XXIV: Barce-Tolmetto-Tocra-Bengasi: *Soc. geol. italiana, Boll.*, vol. 54, p. cxviii.
217. MARIE, PIERRE, Sur les microfaunes du Crétacé des Ganntour (Maroc occidental): *Soc. géol. France, Compte rendu*, pp. 105–107.
218. MARIE, PIERRE, Sur les microfaunes du Crétacé du plateau de Settat (Maroc central): *Soc. géol. France, Compte rendu*, pp. 20, 21.
219. MARIE, PIERRE, De l'utilite des examens micropaléontologiques dans le support des nappes aquifères (exemple de la plaine de Bir Rehid): *Comm. Étude ceaux souterr., Bull.*, 2d ser., vol. 1, no. 9. (*Non vidi*).

MARTIN, LOIS T., *see* CUSHMAN, J. A., and MARTIN, L. T.

MATĚJKA, A., *see* KODYM, O., and MATĚJKA, A.

MAUCHAUSSÉ, P., *see* HOFFHERR, R., and MAUCHAUSSÉ, P.

220. MAWSON, Sir D., and CHAPMAN, F., The occurrence of lower Miocene formation on Bougainville Island: *Royal Soc. South Australia, Trans.*, vol. 59, pp. 241, 242, pl. 3.

MAYNC, WOLF, *see* LEUPOLD, W., and MAYNC, W.

MCGUIRT, JAMES H., *see* HOWE, H. V., and MCGUIRT, J. H.

MCLEARN, F. H., *see* FRASER, F. J., and others.

221. MERLA, GIOVANNI, Osservazioni preliminari sul Permiano della valle Shaksgam (Caracorum): *Soc. geol. italiana, Boll.*, vol. 54, pp. 153–159.

222. MEZNERICS, T., Stájerországi slir-fauna és nj alakjai. (Steiermärkische Schlierfauna und ihre neuen Formen): *Földtani Közlöny*, vol. 55, pp. 322–341, 1 pl., 1 table.

MILLER, A. K., *see* THOMPSON, M. L., and MILLER, A. K.

MONTGOMERY, J. C., *see* STAMEY, R. A., EASTON, H. D., JR. and MONTGOMERY, J. C.

223. MOORE, RAYMOND C., Late Paleozoic crustal movements of Europe and North America: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1253–1307, 14 text figs.

224. MORELLET, L. and J., Étude sur le niveau d'Hérouval (Oise): *Soc. géol. France, Bull.*, 5th ser., vol. 5, pp. 499–508.

225. MORET, LÉON, Sur la présence de *Nummulites incrassatus* dans le "flysch calcaire" des environs d'Orcières (nappe du flysch de l'Embrunais) et sur la répartition des faciès du Nummulitique dans la géosynclinal alpin: *Soc. géol. France, Compte rendu*, pp. 30, 31, 1 text fig.

226. MORET, LÉON, La réunion de la Société géologique italienne en Cyrenaique (avril 1935): *Soc. géol. France, Compte rendu*, pp. 155–157.

227. MORNHINVEG, A. R., and GARRETT, J. B., JR., Study of Vicksburg group at Vicksburg, Miss.: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1645–1667, 5 text figs.

228. MURATA, K. J., A neglected method for making thin sections of fossils: *Jour. Paleontology*, vol. 9, pp. 359–361.

229. MUTSCHLECHNER, G., Die angeblichen Nummuliten von St. Cassian (Enneberger Dolomiten): *Geol. Bundesanstalt Wien, Verh.*, pp. 80–82.

230. MYERS, EARL H., The life history of *Patellina corrugata* Williamson, a foraminifer: *Scripps Inst. Oceanography, Bull.*, Tech. ser., vol. 3, no. 15, pp. 355–392, pls. 10–16, 1 text fig.

231. MYERS, EARL H., Culture methods for marine Foraminifera of the littoral zone: *Am. Micr. Soc., Trans*, vol. 54, pp. 264–267.

232. MYERS, EARL H., Morphogenesis of the test and the biological significance of dimorphism in the foraminifer *Patellina corrugata* Williamson: *Scripps Inst. Oceanography, Bull.*, Tech. ser., vol. 3, no. 16, pp. 393–404, 1 text fig.

233. NEVIANI, ANTONIO, Appunti per una storia intorno ai foraminiferi dall'antichità al secolo XVIII: *Pont. accad. sci. Nuovi Lincei, Mem.*, 3d ser., vol. 2, pp. 131–210, 3 text figs.

234. NOMURA, S., Miocene Mollusca from the Nisi-Tugaru district, Aomoriken, northeast Honsyû, Japan: *Saito Ho-on Kai Mus., Research Bull.*, vol. 6, pp. 19–81, 7 pls.

235. NUTTALL, W. L. F., Upper Eocene Foraminifera from Venezuela: *Jour. Paleontology*, vol. 9, pp. 121–131, pls. 14, 15.

ØDUM, HILMAR, *see* MADSEN, V., ØDUM, H., and GRY, H.

236. OGILVIE-GORDON, M., Geologie von Cortina d'Ampezzo und Cadore: *Geol. Bundesanstalt Wien, Jahrb.*, vol. 84, pp. 59–215, 17 pls., 32 text figs.

237. ÖKONOMIDES, G. TH., Beiträge zur Kenntnis des Palaeogens und Neogens auf der Insel Naxos: *Geol. Bundesanstalt Wien, Jahrb.*, vol. 85, pp. 333–345.

238. OPPL, EGON, Beiträge zur Kenntnis des Miozäns im Niederen Gesenke und in der Umgebung von Brünn: *Lotos* (Prag), vol. 83, reprint, 9 pp.

239. OTUKA, Y., The Oti Graben in southern Noto peninsula, Japan; part 3: *Earthquake Research Inst. Japan, Bull.*, vol. 13, pp. 846–909, pls.

240. PAALZOW, RICHARD, Die Foraminiferen im Zechstein des östlichen Thüringen: *Preuss. geol. Landesanstalt, Jahrb.*, vol. 56, pp. 26–45, pls. 3–5.

PARKER, FRANCES L., *see* CUSHMAN, J. A., and PARKER, F. L.

241. PARKS, W. A., Systematic position of the Stromatoporoidea: *Jour. Paleontology*, vol. 9, pp. 18–29, pls. 6, 7.

242. PARONA, C. F., Di alcune rudiste delle Zardeh Kuh in Persia: *R. Accad. sci. Torino, Atti*, vol. 70, pp. 1–15, 1 pl., 1 text fig.

243. PARR, WALTER J., Some Foraminifera from the Awamoan of the Medway River district, Awatere, Marlborough,

New Zealand: *Royal Soc. New Zealand, Trans.*, vol. 65, pp. 77–87, pls. 19, 20, text figs. 1, 2.
PARR, WALTER J., *see* CHAPMAN, F., and PARR, W. J.

244. PÉRÉBASKINE, V., and SCHNEEGANS, D., Note préliminaire sur les foraminifères provenants d'un sondage foré dans la région du détroit de Magellan (Chili): *Soc. géol. France, Compte rendu*, pp. 104, 105.

245. PFALZ, RICHARD, Die wichtigsten Ergebnisse neuer geologischer Forschungen in Tripolitanien und der Cyrenaika: *Centralbl. Mineralogie, Abt. B*, pp. 203–210.

246. PFENDER, JULIETTE, Sur un foraminifère nouveau du Bathonien des Montagnes d'Escreins (H.-Alpes), *Kilianina blancheti* nov. gen. nov. spec.: *Grenoble Univ. Lab. géologie, Travaux*, vol. 19, pp. 243–252, pls. 1, 2, 3 text figs.
PIVETEAU, JEAN, *see* BOULE, M., and PIVETEAU, J.

247. PLUMMER, F. B., and HORNBERGER, JOSEPH, Geology of Palo Pinto County, Tex.: *Univ. Texas, Bull.* 3534, 240 pp., 7 pls., 28 figs., 22 tables.

248. PLUMMER, HELEN JEANNE, Microscopical evidence of the Navarro-Taylor contact in subsurface sections in central Texas: *Univ. Texas, Bull.* 3501, pp. 281–292, pl. 5, 2 text figs.

249. POTONIÉ, R., Ergebnisse der Mikropaläontologie bei Erdölbohrungen und sonstigen praktisch-stratigraphischen Arbeiten: *Preuss. geol. Landesanstalt, Jahrb.*, vol. 55, pp. 49, 50.

250. PRINCIPI, PAOLO, I tereni terziari della Conca Aquilana: *Soc. geol. italiana, Boll.*, vol. 54, pp. 11–40, 3 text figs.

251. RAO, NARAYANA S. R., and RAO, SRIPADA, K., On the occurrence of foraminifers and radiolarians in the infra-trappean limestones near Pangadi-Rajahnundry: *Current Sci.*, Bangalore, vol. 3, p. 365.

252. RAUSER-ČERNOUSSOVA, DAGMAR, Bemerkungen über die Gattung *Wedekindellina* Dunbar et Henbest und ihre stratigraphische Bedeutung: *Acad. sci. U.R.S.S., Comptes rendus*, vol. 4 (9), pp. 117–120.

253. RAUSER-ČERNOUSSOVA, DAGMAR, On the Lower Permian age of the sediments with *Pseudofusulina lutugini* (Schellwein) on the western slope of the Ural: *Soc. naturalistes Moscou, Bull.*, vol. 13, 1st ser., pp. 129–149: Russian text, pp. 150–154: summary in English, pls. 1, 2.

254. RAUSER-ČERNOUSSOVA, DAGMAR, and KIREEWA, GALINA, Über Polymorphismus und Variabilität bei *Fusulina minima* Schwellwien; *Palaeont. Zeitschr.*, vol. 17, pp. 244–257, 8 text figs.

255. RAYMOND, PERCY E., Pre-Cambrian life: *Geol. Soc. America, Bull.*, vol. 46, pp. 375–392.

256. REED, F. R. COWPER, Notes on the Neogene fauna of Cyprus II: *Annals and Mag. Nat. History*, ser. 10, vol. 15, pp. 1–37, 4 pls.

257. RENZ, HANS H., Zur Stratigraphie und Paläontologie der *Mytilus*-Schichten im östlichen Teil der Préalpes romandes: *Eclog. geol. Helvetiae*, vol. 28, pp. 141–247, pls. 12, 13.

258. RHUMBLER, L., *Rhizopoda* der Kieler Bucht, gesammelt durch A. REMANE. 1. Teil: *Naturwiss. Ver. Schleswig-Holstein, Schr.*, vol. 21, pp. 143–194, figs 1–216.

259. RICHTER, KONRAD, Horizontbestimmung von Ober-Kreidegeschieben mittels Foraminiferenstatistik: *Frankfurter Beitr. Geschiebeforschung*, pp. 20–28, 3 text figs.

260. RIEBEN, HUBERT, Contribution à la géologie de l'Azerbeidjan persan: *Soc. neuchâteloise sci. nat., Bull.*, vol. 59, année *1934*, 1935, pp. 19–144, 2 pls., 7 text figs.

261. ROBAUX, ALBERT, Sur l'existence de l'Éocène supérieur et de l'Oligocène dans la série du flysch au sud de la province de Cadix: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 685–687.

262. ROBAUX, ALBERT, Sur la présence du Crétacé supérieur à la base de série du flysch du sud de la province de Cadix: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 478–480.

263. ROBAUX, ALBERT, Extension des formations du Crétacé supérieur, de l'Éocène et de l'Oligocène de la série du flysch dans le sud de la province de Cadix: *Acad. sci. Paris, Comptes rendus*, vol. 200, pp. 955–957.

264. ROZLOZSNIK, P., Adatok a Buda-Kovácsi-f-hegység óharmadkori réteginek ismeretéhez (Beiträge zur Kenntnis des Paläogens des Buda-Kovácsier-Gebirges): *Magyar k. földtani intézet. Évi jelentéseiaz 1925–1928 evekről.*, 1935. (Jahrb. k. Ungar. geol. Anstalt) pp. 65–86, 9 text figs. (Hungarian with summary in German.)
RUSSELL, L. S., *see* FRASER, F. J., and others.

265. RUTTEN, M. G., *Orbitocyclina* Vaughan, a synonym of *Lepidorbitoides* Silvestri: *K. Akad. Wetensch. Amsterdam, Proc.*, vol. 38, pp. 186, 187, 1 pl.

266. RUTTEN, M. G., Larger Foraminifera of northern Santa Clara province, Cuba: *Jour. Paleontology*, vol. 9, pp. 527–545, pls. 59–62, 4 text figs.

267. RUTTEN, M. G., A note on *Actinosiphon*

vichayalensis (Rutten): *Jour. Paleontology*, vol. 9, pp. 546, 547, 2 text figs.

268. RUTTEN, M. G., Zur Einführung geographischer Rassenkreise bei fossilen Foraminiferen. Antwort an HANS E. THALMANN: *Palaeont. Zeitschr.*, vol. 17, pp. 257–262.

269. SÁËNZ, GARCÍA CLEMENTE, Nuevo jalón occidental de la caliza de Alveolinas: *Soc. española historia nat., Bol.*, vol. 35, p. 236.

270. SAHNI, M. R., On the probable underground occurrence of Tertiary rocks near Puri: *India Geol. Survey, Rec.*, vol. 68, pt. 4, pp. 418, 419.

271. SALIN, ED., Monographie des calcaires du Barrois: *Soc. géol. France, Bull.*, 5th ser., vol. 5, pp. 117–166, 3 pls., 7 text figs.

272. SANDIDGE, JOHN R., Cretaceous Foraminifera in Angola (abstract): *Geol. Soc. America, Proc. for 1934*, June, 1935, pp. 371, 372.

273. SCARSELLA, FRANCO, Breve cronaca delle escursioni della Società geologica italiana in Cirenaica: *Soc. geol. italiana, Bol.*, vol. 54, pp. cxliii–clxxvi, 14 text figs.

273a. SUARIN, E., Études géologiques sur l'Indochine du sud-est (Sud-Annam, Cochinchine, Cambodge oriental): *Indochine Service géol., Bull.*, vol. 22, 1st ser., pp. 1–149, 15 pls., 1 map.

274. SCHENCK, HUBERT G., What is the Vaqueros formation of California, and is it Oligocene?: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 521–536.

275. SCHENCK, HUBERT G., Nuculid pelecypods of the genus *Acila* in the Tertiary of Venezuela, northern Colombia, and Trinidad: *Eclog. geol. Helvetiae*, vol. 28, pp. 501–510. (Note on Foraminifera of the Las Perdices shale at Puerto Colombia, by H. D. HEDBERG, p. 504).

276. SCHMIDT, HERMANN, *Einführung in die Paläontologie*, Stuttgart (Enke), 253 pp., 466 text figs.

277. SCHMIDT, HERMANN, Die bionomische Einteilung der fossilen Meeresböden: *Fortschr. Geologie u. Palaeontologie*, vol. 12, Heft 38, 154 pp., 24 text figs.

SCHNEEGANS, D., *see* BARRABÉ, L., and SCHNEEGANS, D.

SCHNEEGANS, D., *see* PÉRÉBASKINE, V., and SCHNEEGANS, D.

278. SCHOTT, GERHARD, *Geographie des Indischen und Stillen Ozeans*, Hamburg (Boysen), 413 pp., 47 pls., 114 text figs. (*Note:* A chapter on bottom deposits, written by W. SCHOTT, and a chapter on the life in the Indian and Pacific oceans written by E. HENTSCHEL.)

279. SCHOTT, WOLFGANG, Die Foraminiferen in dem äquatorialen Teil des Atlantischen Ozeans: *Deutsche Atlant. Expedition "Meteor," Wiss. Ergebn.*, vol. 3, pt. 3, sec. B, pp. 43–134, 3 charts, text figs. 18–57.

280. SCHOTT, WOLFGANG, Stratigraphie der rezenten Tiefseesedimente im äquatorialen Atlantischen Ozean (nach Ergebnissen der "Meteor"-Expedition): *Deutsche geol. Gesell., Zeitschr.*, vol. 87, pp. 278, 279.

281. SCHUCHERT, CHARLES, *Historical geology of the Antillean-Caribbean region or the lands bordering the Gulf of Mexico and the Caribbean Sea*, New York (Wiley), xxvi+811 pp., 107 figs., 16 pls.

282. SCHUCHERT, CHARLES, Correlation of the more important marine Permian sequences: *Geol. Soc. America, Bull.*, vol. 46, pp. 1–46, pl. 1, 1 text fig.

283. SEMICHATOV, S. V., The Middle Carboniferous of Russia: *Geol. Mag.*, vol. 72, pp. 433–441.

284. SENN, ALFRED, Die stratigraphische Verbreitung der tertiären Orbitoiden, mit spezieller Berücksichtigung ihres Vorkommens in Nord-Venezuela und Nord-Marokko: *Eclog. geol. Helvetiae*, vol. 28, pp. 51–113, pls. 8, 9, 1 text fig.

285. SENN, ALFRED, Nachtrag zu: Die stratigraphische Verbeitung der tertiären Orbitoiden: *Eclog. geol. Helvetiae*, vol. 28, pp. 369–373.

SCHROCK, ROBERT R., *see* TWENHOFEL, W. H., and SHROCK, R. R.

SIEGFUS, STANLEY S., *see* CUSHMAN, J. A., and SIEGFUS, S. S.

286. SILVESTRI, ALFREDO, Rocee e fossili del Paleozoico superiore raccolti dalla Spedizione geografica italiano nel Caracorum (1929). Parte 2: I fossili: *Pont. accad. sci. Nuovi Lincei, Mem.*, 3d ser., vol. 2, pp. 79–115, pls. 1–3.

287. SILVESTRI, ALFREDO, Petrae et fossiles paleozoici superioris in Caracorum: *Scientiarum nuncius radiophonicus, Pont. accad. sci. Nuovi Lincei*, no. 37, pp. 8, 9.

288. SILVESTRI, ALFREDO, Sulla validità del genere Fusulina Fischer: *Soc. geol. italiana, Boll.*, vol. 54, pp. 203–219, pl. 9, 3 text figs.

SKINNER, JOHN W., *see* DUNBAR, C. O., SKINNER, J. W., and KING, R. E.

289. SOERGEL, W., Wilhelm Deecke†: *Oberrhein. geol. Ver., Jahresber. und Mitt.*, N. F., vol. 24, pp. xiii, xiv, 1 photo.

290. SOS, V., Existencia del cenomanense en las proximidades de Castellón: *Soc. española historia nat., Bol.*, vol. 35, pp. 507–512, 2 pls., 1 text fig.

291. SPÁLEK, V., Nová stratigrafie neógenu okoli Hrušovan nad Jev. (Eine neue Stratigraphie des Neogens der Umgebung von Grussbach): *Sborn. klubu přírodoved Brünn*, vol. 18, pp. 1–17. (Czechoslovakian with summary in German.)

292. SPÄRCK, R., On the importance of the quantitative investigation of the bottom fauna in marine biology: *Jour. Conseil maritime Copenhague*, vol. 10, pp. 3–19.
293. SPIKER, E. TH. N., Geologie von West Ibiza (Balearen): *Univ. Utrecht, Proefschr.* (*Dissert.*), pp. 1–63, pls. 1–4, 5 text figs. (Also published in *Géol. Méditerranée occid.*)
294. STAMEY, R. A., MONTGOMERY, J. C., and EASTON, H. D., JR., Greta oil field, Refugio County, Tex.: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 544–559, 7 text figs.
295. STEFANINI, G., Il complesso eruttivo di Orciatico e Montecatini in provincia di Pisa. 4. I fossili della termantite di Orciatico: *Soc. toscana sci. nat., Atti, Mem.*, vol. 44, pp. 1–79, pls. 1–7.
296. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. I. Notizie generali sulla cosstituzione fisica della Cirenaica: *Soc. geol. italiana, Boll.*, vol. 54, pp. xxxix–xliv, text fig. 2.
297. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. II. I distorni di Bengasi: *Soc. geol. italiana, Boll.*, vol. 54, pp. xlv–xlix, text fig. 3.
298. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. IX. Il Sahel e il primo gradino dell' Altipiano: *Soc. geol. italiana, Boll.*, vol. 54, pp. lxxii–lxxiv, text fig. 12.
299. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. XII. Il secondo gradino dell'Altipiano presso Barce: *Soc. geol. italiana, Boll.*, vol. 54, pp. lxxxiii–lxxxiv, text fig. 15.
300. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. XV. Panorama geologico de Cirene e Gita Cirene—Apollonia: *Soc. geol. italiana, Boll.*, vol. 54, pp. xci–xciii, text fig. 27.
301. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. XX. La serie terziaria di Derna: *Soc. geol. italiana, Boll.*, vol. 54, pp. cxi-cxiii, text figs. 23–25.
302. STEFANINI, G., Breve guida alle escursioni geologiche in Cirenaica. XXIII. Derna-Cirene-Beda Littorina-Messa-Barce: *Soc. geol. italiana, Boll.*, vol. 54, pp. cxvi-cxvii, text figs. 27, 28.
303. STEPHENSON, MORTON B., Some microfossils of the *Potamides matsoni* zone of Louisiana: *Louisiana Dept. Cons., Geol. Bull.* 6, pp. 187–196, pl. 5.
304. STORM, H., Zur Kenntnis der gy-3-Schichten bei Hlubočep (Prag): *Lotos* (Prag), vol. 83, pp. 11–25.
305. STUTZER, OTTO, Mikrofaunentafeln zur Bestimmung von Unterkreide-Horizonten in Bohrkernen norddeutscher Oelfelder. I. Vorwort: *Oel und Kohle*, vol. 11, p. 388.

SUGIYAMA, T., *see* YABE, H., and SUGIYAMA, T.

306. SUZUKI, KOITI, and TAKAI, HUYUZI, Fossiliferous beds in the vicinity of Tako-mati, Tiba prefecture: *Geol. Soc. Tokyo, Jour.*, vol. 42, pp. 1–35.

TAKAI, HUYUZI, *see* SUZUKI, K., and TAKAI, H.

307. TAN SIN HOK, Die peri-embryonalen Äquatorialkammern bei einigen Orbitoiden: *De Ing. in Nederlandsch-Indië, Geol. mijnb.*, vol. 2, pt. 4, pp. 113–126, 1 pl.
308. TAN SIN HOK, Über *Lepidocyclina gigantea* K. Martin von Süd-Priangan (Westjava), Tegal (Mitteljava) und Benkoelen (Sumatra): *De Ing. in Nederlandsch-Indië, Geol. mijnb.*, vol. 2, pt. 4, pp. 1–8, pls. 1–3.
309. TAN SIN HOK, Zwei neue mikrosphäre Lepidocyclinen von Java: *De Ing. in Nederlandsch-Indië, Geol. mijnb.*, vol. 2, pt. 4, pp. 9–18, pls. 4–7.
310. TAN SIN HOK, Zur Theorie des Trimorphismus und zum Initialpolymorphismus der Foraminiferen: *Natuurk. tijdschr. Ned.-Indië*, vol. 95, pp. 171–188.
311. THALMANN, HANS E., Miocene Agueguexquite formation in the Isthmus of Tehuantepec region (abstract): *Geol. Soc. America, Proc. for 1934*, June, 1935, p. 116.
312. THALMANN, HANS E., Age of Velasco formation in eastern Mexico (abstract): *Geol. Soc. America, Proc. for 1934*, June, 1935, p. 371.
313. THALMANN, HANS E., Bibliography and index to new genera, species and varieties of Foraminifera for the year 1934: *Jour. Paleontology*, vol. 9, pp. 715–743.
314. THALMANN, HANS E., Mitteilungen über Foraminiferen II.: *Schweiz. naturf. Gesell., Verh.* 116, pp. 340, 341.
315. THALMANN, HANS E., Die miozäne Tuxpan-Stufe im Gebiete zwischen Rio Tuxpan und Rio Tecolutla (Staat Veracruz, Ost-Mexico): *Eclog. geol. Helvetiae*, vol. 28, pp. 543–456.
316. THALMANN, HANS E., Mitteilungen über Foraminiferen II. 5. Stratigraphisch wertvolle Foraminiferen im Tertiär des Coatzacoalcos-Beckens (Isthmus von Tehuantepec, Mexico): *Eclog. geol. Helvetiae*, vol. 28, pp. 592–598.
317. THALMANN, HANS E., Mitteilungen über Foraminiferen II. 6. Weitere Vorkommen von *Globotruncana* in der Oberkreide: *Eclog. geol. Helvetiae*, vol. 28, pp. 598–601.
318. THALMANN, HANS E., Mitteilungen über Foraminiferen II. 7. Liste der Foraminiferen von der Typus-Lokalität der miozänen Tuxpan-Stufe (Ciudàd de Tuxpan, Veracruz, Mexico): *Eclog. geol.*

Helvetiae, vol. 28, pp. 602–605, 2 text figs.

319. THALMANN, HANS E., Mitteilungen über Foraminiferen II. 8. *Rotalia indopacifica* nom. nov. im indopazifischen Verbreitungsgebiet: *Eclog. geol. Helvetiae*, vol. 28, pp. 605, 606.
320. THEOBALD, N., Sur l'extension des faciès de la base du Stampien (marnes à foraminifères et schistes à Amphisiles) dans le Haut-Rhin: *Soc. géol. France, Compte rendu*, pp. 209, 210.
321. THEODOROWITSCH, G. J., Zur Geologie des Mittel- und Oberkarbons des westlichen Abhanges des Süd-Urals: *Soc. naturalistes Moscou, Bull.*, vol. 43, pp. 81–100. (Russian with summary in German.)
322. THOMAS, H. DIGHTON, The economic importance of the Foraminifera: *Nature* (London), vol. 136, pp. 130–132, 1 text fig.
323. THOMAS, H. DIGHTON, Some aspects of evolution: *South-Eastern Union Sci. Soc., Trans.*, pp. 57–79, 2 tables, 6 text figs.
324. THOMAS, NORMAN L., Texas index micro-fossils (abstract): *Geol. Soc. America, Proc. for 1934*, June 1935, pp. 369, 370.
325. THOMPSON, M. L., The fusulinid genus *Staffella* in America: *Jour. Paleontology*, vol. 9, pp. 111–120, pl. 13.
326. THOMPSON, M. L., Fusulinids from the lower Pennsylvanian Atoka and Boggy formations of Oklahoma: *Jour. Paleontology*, vol. 9, pp. 291–306, pl. 26.
327. THOMPSON, M. L., The fusulinid genus *Yangchienia* Lee: *Eclog. geol. Helvetiae*, vol. 28, pp. 511–517, pl. 17.
328. THOMPSON, M. L., and MILLER, A. K., *Schwagerina* from the western edge of the Red Basin, China: *Jour. Paleontology*, vol. 9, pp. 647–652, pl. 79.
329. THOMPSON, SHERIDAN A., Fredericksburg group of Lower Cretaceous with special reference to north-central Texas: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 19, pp. 1508–1537, 6 pls., 3 text figs.
330. TRECHMANN, C. T., The geology and fossils of Carriacou, West Indies: *Geol. Mag.*, vol. 72, pp. 529–555, pls. 20–22, 3 text figs.
331. TROEDSSON, G., Några geologiska resultat från de senaste årens djupborringar i nordvästra Skåne: *Geol. fören. Stockholm, Förh.*, vol. 57. (*Non vidi.*)
332. TWENHOFEL, WILLIAM, and SHROCK, ROBERT R., *Invertebrate Paleontology*, New York (McGraw-Hill), 511 pp., illustr.

TZANKOV, V., *see* BAKALOV, F., and TZANKOV, V.

333. UMBGROVE, J. H. F., De pretertiaire historie van den Indischen Archipel (met bijdragen van DR. FRIEDR. WEBER): *Leidsche geol. mededeel.*, vol. 7, pt. 1, pp. 119–155, pl. 2, 6 text figs.

VĂSCĂUTANU, THÉODORE, *see* MACAROVICI, N. G., and VĂSCĂUTANU, TH.

VLERK, I. M. VAN DER, *see* GEYN, W. A. E. VAN DE, and VLERK, I. M. VAN DER.

334. VINASSA DE REGNY, P., Torquato Taramelli, 1845–1922: *Trentini sci. nat. studi*, vol. 15, Trento. (*Non vidi.*)
335. VOLOSHINOFF, N. F., Microfauna of Tertiary formations of the Sakhalin island: *The Petroleum Industry*, Moscow, pp. 36–39, 1 table. (In Russian.)
336. WAAGEN, L., Die Tiefbohrung Engelmann in Hernals: *Geol. Bundesanstalt Wien, Jahrb.*, vol. 85, pp. 287–307.
337. WADIA, D. N., On the Cretaceous and Eocene volcanic rocks of the great Himalaya range in North Kashmir: *India Geol. Survey, Rec.*, vol. 63, pp. 419–421, pl. 33.
338. WANNER, J., and HAHN, E., Miozäne Mollusken aus der Landschaft Rembang (Java): *Deutsche geol. Gesell., Zeitschr.*, vol. 87, pp. 222–273, pls. 17–21, 3 text figs.

WARREN, P. S., *see* FRASER, F. J., and others.

339. WEBER, H., Die Mikropaläontologie im Dienste der Erdölbohrungen: *Mikrokosmos*, vol. 28, pp. 57–59, 5 figs.
340. WETZEL, O., Fossilien im norddeutschen Feuerstein: *Die Umschau*, Heft 44, reprint, 2 pp., 15 text figs.
341. WETZEL, O., Die Mikropaläontologie des Heiligenhafener Kieseltones (Ober-Eozän): *Niedersachs. geol. Ver., Jahresber.* 27, pp. 41–75, pls. 8–10, 4 text figs.
342. WHEELER, H. E., Timothy Abbott Conrad, with particular reference to his work in Alabama one hundred years ago: *Bull. Am. Paleontology*, vol. 23, no. 77, 157 pp., 27 pls.

WHEELER, H. E., *see* FRIZZELL, D. L., and WHEELER, H. E.

WICKENDEN, R. T. D., *see* FRASER, F. J. and others.

343. WILSER, J. C., Geheimer Hofrat Professor Dr. Wilhelm Deecke: *Badische geol., Abh.*, vol. 6, no. 1, p. 3.
344. WILSON, D. P., *Life of the shore and shallow sea*, London, 150 pp., 128 pls.
345. YABE, H., The middle and lower Mizuko: *Tohoku Imp. Univ., Inst. Geol. Paleont.*, vol. 12, pp. 1–28. (*Non vidi.*)
346. YABE, H., New find of *Miogypsina* in the Tertiary of Mino: *Imp. Acad. Japan, Proc.*, vol. 11, pp. 144, 145, 5 text figs.
347. YABE, H., *Verbeekia* Silvestri, 1908, and

Operculinella Yabe, 1918: *Geol. Soc. Tokyo, Jour.*, vol. 42, p. 58. (In Japanese.)

348. YABE, H., and HANZAWA, S., Foraminifera? remains from Ordovician limestone of Manchuria: *Imp. Acad. Japan, Proc.*, vol. 11, pp. 55–57, 2 text figs.
349. YABE, H., and SUGIYAMA, T., Geological and geographical distribution of reef corals in Japan: *Jour. Paleontology*, vol. 9, p. 183–217, pl. 21, 5 text figs.
350. ZEIJLMANS VAN EMMICHOVEN, C. P. A., and BRUGGEN, G. TER, Bijdragen tot de geologie van Borneo. 1. Voorloopige mededeeling over het tertiair den W. van het Merengebied in de Wester-Afdeeling van Borneo: *De Ing. in Nederlandsch-Indië, Geol. mijnb.*, vol. 2, pt. 4, pp. 99–102, 2 text figs.
351. ZWIERZYCKI J., Die geologischen Ergebnisse der paläobotanischen Djambi-Expedition 1925: *Jaarb. Mijnwezen Ned.-Indië*, vol. 59 (*1930*), 2. gedeelte, Batavia, 1935, pp. 1–70, 2 maps, 5 text figs.

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1931

352. BEELI, M., Les foraminifères: *Bull. naturalistes belges*, vol. 12, pp. 78–83, 32 figs. (=No. 236 for the year 1931.)
353. CHEVALIER, MARCEL, Sur les fossiles éocènes de Santa Lucia près de Santa Pau: *Géol. Mediterranée occident.*, vol. 2, pt. 4, no. 22, pp. 1–4, 4 text figs. (=No. 237 for the year 1931.)
COSIJN, J., *see* UMBGROVE, J. H. F., and COSIJN, J.
354. GYRÖRFFY, I., Magas-Tátrai kavics-collection (Gerölle-Collection aus der Hohen Tatra): *Reg. Univ. Hungar. Francisco-Joseph., Acta litt. ac. sci., Acta chem., min. et phys.*, vol. 2, no. 2, pp. 162–164, 1 text fig. (Hungarian with summary in German.) (=No. 238 of the year 1931.)
355. HARRIS, R. W., Occurrence and significance of certain micro-faunas in the Ordovician of Oklahoma and elsewhere: *Oklahoma Acad. Sci., Proc.*, vol. 12, pp. 56–61, 3 pls. (=No. 239 for the year 1931.)
356. KRÄUTNER, THEODOR, Cercetări geologice în cuveta marginala mesozoică a Bucovinei cu privire specială la regiunea Rarăului. (Geologische Untersuchungen in der mesozoischen Randmulde der Bukowina mit besonderer Berücksichtigung des Rarau-Gebietes): *Inst. geol. Romaniei, Anuarul*, vol. 14, pp. 1–61, 15 pls., 2 maps, 4 sections. (Roumanian and German text.) (=No. 240 for the year 1931.)
357. LERICHE, MAURICE, Les vestiges du "Panisélien" rejetés sur la côte flamande. Le prolongement sous la mer du Nord des assises tertiaires de la Flandre: *Soc. géol. Nord, Annales*, vol. 56, pp. 254–260. (=No. 241 for the year 1931.)
358. PFALZ, R., Nota geologiche sui terreni di el-Gubba e Derna: *Governo Cirenaica, Boll. Geog.*, no. 13 (=No. 242 for the year 1931. (*Non vidi.*)
359. TOLMACHOFF, I. P., A method of cleaning microscopical fossils: *Science*, vol. 73, p. 15. (=No. 243 for the year 1931.)
360. UMBGROVE, J. H. F., and COSIJN, J., Java's zuidkust bij Tji Laoet-Eureun: *Geol. mijnb. genootsch. Nederland en Kolonien, Verh., geol. ser.*, vol. 9, pp. 121–134, 12 figs. (=No. 244 for the year 1931).
361. VOIGT, E., Faziesstudien in der baltischen Schreibkreide auf Grund neuerer Untersuchung: *Halle'scher Verband Erforsch. mitteldeutsch. Bodenschätze Jahrb.*, vol. 7. (=No. 245 for the year 1931.)

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1932

362. BOGDANOWICZ, A., and VASSOYEWITSCH, N. B., Oil indications in the vicinity of the villages Udjarmo, Mukhrovany etc.: *Oil Geol. Inst. Moscow, Trans.*, ser. B, vol. 34, pp. 1–20. (=No. 320 for the year 1932.)
363. DOUTKEVITCH, G. A., The deepest bore well in the Ural and outlooks of deep prospecting in the Verkhne-Chussovskye Gorodki: *Oil Geol. Inst., Moscow, Trans.*, ser. B., vol. 40. (=No. 321 for the year 1932.)
364. EVANS, P., Explanatory notes to accompany a table showing the Tertiary succession in Assam: *Min Geol. Inst. India, Trans.*, vol. 27, pt. 3, pp. 155–260, pls. 1–5, 9 text figs. (=No. 322 for the year 1932.)
365. GLANGEAUD, L., Étude géologique du littoral de la province d'Alger: *Services carte géol. Algérie, Bull*, 2d ser., no. 8. (=No. 323 for the year 1932.)
366. HAYASAKA, ICHIRO, Geological materials on the substratum of the Dune formation around Tainan: *Taiwan Tigaku Kizi*, vol. 3, p. 110. (Japanese with summary in English.) (=No. 324 for the year 1932.)
367. HOJNOS, R., Über die Triasbildungen vom nordwestlichen Rande des Balatonsees: *Földtani Szemle*, Budapest, vol. 1, pp. 121–137, 1 text fig. (=No. 325 for the year 1932.)
368. HOLTEDAHL, O., HEINTZ, A., HOEG, O. A., and VOGT, T., Johan Kiaer, 11 Oct. 1869–31 Oct. 1931: *Norsk geol. tidsskr.*, vol. 11, pp. 415–436. (=No. 326 for the year 1932.)
ILIE, MIRCEA, *see* KRÄUTNER, TH., and ILIE, M.

369. KRÄUTNER, TH., and ILIE, MIRCEA, Observations sur la zone des lambeaux jurassiques entre Valea Stremtului et Valea Ampoiului (Monts Metalici): *Inst. géol. Roumanie, Comptes rendus*, vol. 20, pp. 96–104. (=No. 327 for the year 1932.)
370. MAGDEFRAU, K., *Algites furcellaroides* n. sp., eine neue Alge aus dem baltischen Obersenon: *Zeitschr. Geschiebeforschung*, vol. 8. (=No. 328 for the year 1932.)
371. MAYER, F. K., Über die Modifikation des Calciumkarbonates in Schalen und Skeletten rezenter und fossiler Organismen: *Chemie der Erde*, vol. 7, pp. 346–350, 4 text figs. (=No. 329 for the year 1932.)
372. PRINCIPI, PAOLO, Nuove oservazioni intorno alla presenza dell'oligocene nell'-Italia central: *Soc. geol. Italiana, Mem.*, vol. 1, pp. 1–14, pl. 1, 5 text figs. (=No 330 for the year 1932.)
373. SAEDELEER, H. DE, Recherches sur les pseudopodes des Rhizopodes téstacés: *Archiv zool. éxper. génér.*, vol. 74, fasc. 30. (=No. 331 for the year 1932.)
374. SELLARDS, E. H., The pre-Paleozoic and Paleozoic in Texas: *Univ. Texas, Bull.* 3232, pp. 15–238, 1 pl. (=No. 332 for the year 1932.)

VASSOYEWITSCH, N. B., *see* DOGDANOWICZ, A., and VASSOYEWITSCH, N. B. VOGT, T., *see* HOLTEDAHL, O., and others.

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1933

375. ABRARD, RENÉ, La question de l'Auversien dans la région subalpin: *Assoc. franç. av. sci., Comptes rendus*, pp. 227–229. (=No. 365 for the year 1933.)
376. BONTE, A., and REILLER, R., Observations sur la faune du tuffeau landénien de Lille (Porte de Gand): *Soc. géol. Nord, Annales*, vol. 58, pp. 182–186. (=No. 366 for the year 1933.)
377. CLARK, F. W., and WHEELER, W. C., The inorganic constituents of marine invertebrates: *U. S. Geol. Survey, Prof. Paper* 124. (*Non vidi*) (=No. 367 for the year 1933.)
378. DOLLFUS, R. PH., Répertoire bibliographique des publications de Gustave F. Dollfus: *Soc. géol. France, Bull.*, 5th ser., vol. 3, pp. 691–726. (=No. 368 for the year 1933.)
379. DOUVILLÉ, H., Gustave F. Dollfus (1850–1931): *Soc. géol. France, Bull.*, 5th ser., vol. 3, pp. 677–690, 1 portr. (=No 369 for the year 1933.)
380. EDMONDSON, C. H., Reef and shore fauna of Hawaii: *B. P. Bishop Mus., Spec. Pub.*, vol. 22, pp. 1–297, 163 figs. (=No. 370 for the year 1933).
381. FILIPESCU, M. M. G., A propos de l'Aquitanien entre Valea Teleajenului et la valea Doftanei dans le district de Prahova: *Inst. géol. Roumanie, Comptes rendus*, vol. 19, pp. 14–19, 1 pl. (=No. 371 for the year 1933.)
382. FILIPESCU, M. M. G., Note préliminaire sur les recherches géologiques dans la région comprise entre la Valea Teleajenului et la Valea Doftanei, dans les district de Prahova: *Inst. géol. Roumanie, Comptes rendus*, vol. 19, pp. 9–14.(=No. 372 for the year 1933.)
383. FREBOLD, HANS, Weitere Beiträge zur Kenntnis des oberen Paläozoikums Ostgrönlands. I. Die Fauna und stratigraphische Stellung der oberpaläozoischen weissen Blöcke (Kap Stosch-Formation) Ostgrönlands: *Meddelelser om Grønland*, vol. 84, no. 7, pp. 1–61, 6 pls., 1 text fig. (=No. 373 for the year 1933.)
384. FRIEDBERG, W., Beiträge zur Kenntnis des Miozäns von Polen: *Soc. géol. Pologne, Annales*, vol. 9, pp. 51–56, and 197–236. (Polish with summary in German.) (=No. 374 for the year 1933.)
385. MACFADYEN, W. A., Notes on the Foraminifera in: FOWLER, G.: Fenland waterways, past and present. South level district, part 1: *Cambridge Antiquarian Soc., Comm.*, vol. 33, Appendix I, pp. 125–127. (=No. 375 for the year 1933.)
386. MACFADYEN, W. A., Notes on the Foraminifera in: GEORGE, T. N., The submerged Forest series near Barmouth, with notes on the distribution of *Scrobicularia: Swansea Sci. Nat. Soc., Proc.*, vol. 1, pt. 7, pp. 190, 191. (=No. 376 for the year 1933.)
387. MEYERS, E. H., A mouth pipette and containers for smaller organisms: *Science*, vol. 77, pp. 609, 610. (=No. 377 for the year 1933.)
388. PÉRÉBASKINE, VICTOR, Contribution à l'étude géologique du Soudan oriental: *Agence gén. colonies, Bull.*, vol. 26, pp. 448–483, 9 pls., 11 text figs. (=No. 378 for the year 1933.)

REILLER, R., *see* BONTE, A., and REILLER, R.
389. SOARES, J. M. S., Une nouvelle méthode pour l'étude biologique et paléontologique des foraminifères: *Soc. Portug. sci. nat., Bull.*, vol. 11, pp. 229–249, 3 pls., 4 text figs. (=No. 379 for the year 1933.)
390. SOLÉ SABARIS, L., La geologia dels voltants de Figueres i la tectonicà de l'Empordà: *Inst. catalana historia nat., Buttl.*, vol. 33, pp. 250–257, pl. 10, 3 text figs. (=No. 380 for the year 1933.)

WHEELER, *see* CLARK, and WHEELER.

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1934

391. BARRABÉ, LOUIS, Rapport sur les résultats d'une mission pour la recherche du pétrole à la Guadeloupe (juillet-octobre 1933): *Office nat. combust. liquides, Annales*, pp. 625–661, 1 pl., 2 maps, 3 text figs. (=No. 325 for the year 1934.)
392. BENSON, W. N., The geology of the region about Preservation and Chalky inlets, southwest Fiordland, New Zealand I.: *New Zealand Inst., Trans. and Proc.*, vol. 63, pp. 393–432, 2 pls., 2 maps, 2 text figs. (=No. 326 for the year 1934.)
393. BLANCHET, F., Étude géologique des montagnes d'Escreins: *Soc. sci. Dauphiné, Bull.*, vol. 54, pp. 25–207, 22 pls. (=No. 327 for the year 1934.)
394. BLANCHET, F., Études géologiques des montagnes d'Escreins (Hautes-Alpes et Basses-Alpes): *Grenoble Univ., Lab. géologie, Travaux*, vol. 18, fasc. 1. (=No 328 for the year 1934.)
395. BURRARD, S. G., HAYDEN, H. H., and HERON, A. M., A sketch of the geography and geology of the Himalaya Mountains and Tibet. Part 4, The geology of the Himalaya: *Government of India, Delhi*, pp. V, 278–359, xxxii, pls. 38–52. (=No. 329 for the year 1934.)
396. CHHIBBER, H. L., *The geology of Burma*, London (Macmillan), xxviii+538 pp., 26 pls., 37 text figs. (=No. 330 for the year 1934.)
397. DAIN, L. G., Foraminifera of the upper Jurassic and Cretaceous of Djaiksy Bai oil field (Termir region): *Oil Geol. Inst. Moscow, Trans.*, ser. A., no. 43. (*Non vidi*) (=No. 331 for the year 1934.)
398. DAMPEL, N. I., Foraminifera from the Upper Cretaceous of the Karaton field (Emba region): *Oil Geol. Inst. Moscow, Trans.*, ser. A, vol. 50, pp. 1–35, 4 pls., 2 text figs., 1 table. (Russian with summary in English.) (=No. 332 for the year 1934.)
399. DANGEARD, L., Sur les pisolithes du Jurassique: *Soc. linnéenne Normandie, Bull.*, 8th ser., vol. 7, pp. (30)–(32). (=No. 333 for the year 1934.)
400. DARTEVELLE, E., Les *Nummulites* de l'Éocène belge: *Naturalistes Belges, Bull.*, vol. 15, pp. 190–192, and 206–211, 7 text figs. (=No. 334 for the year 1934.)
401. DEFLANDRE, G., Sur les microfaunes d'origine planctonique conservés à l'état de matière organique dans les silex de la craie: *Acad. sci. Paris, Comptes rendus*, vol. 199, pp. 966–968, 11 text figs. (=No. 335 for the year 1934.)
402. DÉNIZOT, G., Monographies géologiques des environs de Marseille: *Mus. histoire nat. Marseille, Annales*, vol. 26, pp. 5–227, 5 pls. (=No. 336 for the year 1934.)
403. DESIO, ARDITO, Appunti geografici e geologici sulla catena dello Zardeh Kuh in Persia: *Mem. geol. geogr. di Giott. Dainelli*, vol. 4, pp. 139–167, 22 text figs. (=No. 337 for the year 1934.)
404. DOUTKEVITCH, G., The stratigraphy of the Middle Carboniferous of the Urals: *Geol. Petroleum Inst., Mem.*, (A), vol. 55, pp. 3–41. (Russian with brief summary in English.) (=No. 338 for the year 1934.)
405. DOYLE, W. L., Studies in comparative cytoplasmic cytology (Abstract): *Carnegie Inst. Washington, Yearbook*, vol. 33, p. 251. (=No. 339 for the year 1934.)
406. FROMAGET, JACQUES, Contribution à l'étude structurale du sud-est de l'Asie. I. Essai sur l'évolution paléogéographique de l'Indochine et des contrées avoisinantes, depuis le Permien jusqu'au Lias. (Introduction à la tectonique des Indosinides et des plissements plus récents): *Hanoi* (Le-Van-Tan), pp. 1–22, 1 pl. (=No. 340 for the year 1934.)
407. GIGNOUX, M., MORET, L., and SCHNEEGANS, D., Observations géologiques dans le bassin de la Haute-Durance, entre Gap et la frontière italienne: *Grenoble Univ., Lab. géologie, Travaux*, vol. 18. (=No. 341 for the year 1934.)
408. HASE, ALBRECHT, Skelett der Tiere: *Handwörterbuch d. Naturw.* (Fischer-Jena), vol. 9, pp. 100–143, 75 text figs. (=No. 342 for the year 1934.)

HAYDEN, H. H., *see* BURRARD, S. G., and others.

HERON, A. M., *see* BURRARD, S. G., and others.

409. JENNY, J. J., Geologische Beschreibung der Hoh Faulengruppe im Kanton Uri: *Naturf. Gesell. Basel, Verh.*, vol. 45, pp. 109–162, 1 pl., 4 text figs. (=No. 343 for the year 1934.)
410. JOLEAUD, L., Paléogéographie de l'Océan Pacifique: *Soc. Biogéographie, Mém.*, vol. 4, pp. 9–40. (=No. 344 for the year 1934.)
411. KASANZEV, V. P., Materialien zur Kenntnis der Jura-Foraminiferen des Erdölfeldes Makat (Embanepht): *Geol. Erdöl-Inst. Moskau-Leningrad, Mitt.*, (A), Heft 49, pp. 1–32, pls. 1–6. (Russian with summary in German.) (=No. 345 for the year 1934.)
412. KING, L. C., The geology of the lower Awatere district, Marlborough, New Zealand: *Dept. Sci. Ind. Research, Wellington, Geol. Mem.* 2, pp. 1–49, 4 pls., 1 map, 16 text figs. (=No. 346 for the year 1934.)

KRASNOPEVTZEV, N., *see* SCHEGOLOV, D., and KRASNOPEVTZEV, N.

413. KUZNETSOV, S. S., Description of some *Nummulites* from Transcaucasia and the northern Caucasus: *Soc. nat. Leningrad, section géol. et minéralogy, Travaux*, vol. 63, pp. 240–257, 1 pl., 1 text fig. (In Russian; *non vida.*) (=No. 347 for the year 1934.)
414. LAFITTE, R., L'Éocène dans l'Aurès oriental: *Acad. sci. Paris, Comptes rendus*, vol. 199, pp. 1635–1638. (=No. 348 for the year 1934.)
MATSUMOTO, H., *see* OGURA, T., and MATSUMOTO, H.
415. MIRTOVA, AL., The occurrence of Foraminifera in the brackish-water facies of the Akchagyla lake of the Transkam region, Kazan: *Kazan Gos. Univ. obshch. estestv.*, vol. 52, pp. 183–188. (Russian with summary in English; *non vidi.*) (=No. 349 for the year 1934.)
MORET, L., *see* GIGNOUX, M., and others.
416. NAGAO, S., and SASA, Y., Cainozoic formations and latest geological history of the southwestern part of Hokkaido: *Geol. Soc. Tokyo, Jour.*, vol. 41, no. 488. (*Non vidi*). (=No. 350 for the year 1934.)
417. OGURA, T., and MATSUMOTO, H., Pyrite nodules in the coal measures, with special reference to the Yen Tii and Pen Hsi Hu coal fields, south Manchuria: *Ryojun College Engineers, Inouye Commemorat. vol.*, pp. 243–255. (=No. 351 for the year 1934.)
418. RAUSER-ČERNOUSSOVA, D., On the microfauna and the stratigraphical subdivision of the Carboniferous of Samarskaja Luka: *The Petroleum Ind., Moscow*, no. 8. (In Russian; *non vidi.*) (=No. 352 for the year 1934.)
419. SANDON, H., Pseudopodial structure and movements in Foraminifera: *British Assoc. Adv. Sci., Rept.*, vol. 104, p. 318. (=No. 353 for the year 1934.)
SASA, Y., *see* NAGAO, T., and SASA, Y.
420. SCHEGOLEV, D., and KRASNOPEVTZEV, N., The geological and hydrogeological structure of the sedimentary series in the region of the magnetic anomaly of *Kursk: Problems of Soviet Geology*, vol. 10, pp. 92–119. (In Russian.) (=No. 354 for the year 1934.)
SCHNEEGANS, D., *see* GIGNOUX, M., and others.
421. SCHWEZOW, M. S., Über den geologischen Bau des Wolga-Gebietes bei Putschesch-Katunki, des Gebietes des vermeintlichen Endes des Oka-Zna oder des Alatyr-Walles: *Naturf. Gesell. Moskau, Ber., Geol. Abt.*, new ser., vol. 12, pp. 155–164, figs. (Russian with summary in German, *non vidi.*) (=No. 355 for the year 1934.)
422. SEIDLITZ, W. VON, Karl Wilhelm von Gümbel: *Handwörterbuch d. Naturw.* (Fischer-Jena), vol. 5, p. 324. (=No. 356 for the year 1934.)
423. SEIDLITZ, W. VON, Gustav Steinmann: *Handwörterbuch d. Naturw.* (Fischer-Jena), vol. 9, p. 557. (=No. 357 for the year 1934.)
424. SEURAT, L. G., La faune et le peuplement de la Polynésie française: *Soc. Biogéographie Paris, Mém.*, vol. 4, pp. 41–74. (=No. 358 for the year 1934.)
425. TOLSTIKHINA, M., Les dépots carbonifères entre les fleuves de l'Onega et de la Dvina: *Soc. russe minéralogie, Mém.*, vol. 63, pp. 346–376. (Russian with summary in French.) (=No. 359 for the year 1934.)

GENERAL INDEX

(The numbers refer to the publications of the preceding Bibliography.)

General (Handbooks, Biology, Taxonomy, Systematics, Classification, Nomenclature, Habitat, Paleogeography, etc.): 23, 27, 28, 29, 41, 52, 61, 67, 70, 72, 78, 79, 85, 87, 89, 92, 93, 94, 96, 97, 99, 103, 109, 117, 118, 123, 127, 131, 138, 145, 147, 148, 151, 165, 168, 171, 172, 175, 188, 189, 197, 204, 207, 219, 229, 230, 232, 241, 246, 249, 254, 255, 258, 265, 268, 276, 277, 281, 284, 288, 292, 305, 307, 310, 322, 323, 327, 332, 339, 344, 347, 352, 371, 373, 377, 380, 401, 405, 408, 419.

History: 88, 233, 342.

Methods and Technique: 36, 37, 38, 58, 83, 85, 86, 104, 110, 114, 115, 140, 143, 151, 167, 182, 186, 228, 231, 259, 279, 292, 340, 359, 387, 389.

Necrologies and Biographies: 33, 108, 177, 178, 289, 334, 342, 343, 368, 379, 422, 423.

Bibliographies: 67, 152, 162, 313, 378.

STRATIGRAPHIC INDEX

Paleozoic (general): 41, 61, 131, 207, 255, 282, 348, 374.

Cambrian: 151, 156.

Ordovician: 348, 355.

Devonian: 145.

Carboniferous: 14, 16, 30, 34, 40, 44, 49, 116, 119, 121, 141, 157, 223, 247, 252, 254, 288, 321, 325, 326, 333, 351, 363, 404, 406, 418, 421, 425.

Permian: 30, 44, 48, 96, 97, 119, 131, 137, 157, 170, 174, 221, 223, 240, 253, 273, 286, 287, 288, 325, 327, 328, 333, 351, 383, 406, 417, 418, 421.

Triassic: 236, 237.

Jurassic: 77, 78, 102, 105, 106, 146, 158, 173, 183, 184, 185, 196, 204, 205, 209, 211, 246, 257, 271, 331, 369, 393, 394, 397, 399, 411, 420.

Cretaceous: 15, 22, 26, 29, 30, 42, 43, 50, 51, 57, 66, 69, 73, 84, 89, 95, 99, 100, 101, 112, 116, 120, 122, 124, 130, 132, 144, 149, 153, 158, 163, 172, 179, 180, 192, 195, 201, 204,

205, 209, 212, 213, 217, 218, 242, 244, 248, 251, 259, 260, 262, 263, 265, 266, 269, 272, 284, 290, 293, 317, 324, 329, 333, 337, 340, 349, 356, 361, 370, 388, 390, 395, 397, 398, 401, 402, 407, 420.
Tertiary (general): 2, 10, 41, 54, 55, 79, 113, 116, 122, 139, 150, 165, 199, 200, 250, 263, 284, 316, 324, 351, 365, 388, 392, 396, 410, 415, 416.
Eocene: 3, 5, 6, 8, 9, 11, 18, 19, 20, 21, 22, 32, 35, 36, 47, 60, 74, 75, 82, 90, 91, 95, 98, 107, 111, 124, 125, 126, 127, 128, 129, 130, 133, 135, 137, 142, 153, 160, 161, 163, 164, 166, 176, 181, 187, 190, 193, 194, 199, 203, 214, 215, 216, 224, 225, 226, 235, 237, 245, 250, 260, 261, 263, 266, 267, 273a, 284, 285, 296, 298, 299, 300, 301, 302, 307, 312, 316, 337, 341, 349, 352, 353, 354, 358, 364, 375, 376, 382, 395, 400, 403, 409, 413, 414.
Oligocene: 11, 12, 19, 21, 22, 31, 45, 56, 63, 64, 71, 80, 81, 82, 95, 124, 125, 126, 127, 130, 133, 134, 144, 155, 161, 199, 226, 227, 237, 250, 261, 263, 264, 274, 284, 285, 294, 296, 300, 301, 316, 320, 330, 372, 381.
Miocene: 21, 23, 24, 25, 31, 45, 59, 70, 82, 87, 95, 124, 125, 126, 132, 133, 137, 138, 150, 153, 155, 161, 171, 193, 199, 210, 220, 222, 234, 238, 239, 243, 244, 250, 256, 270, 275, 284, 291, 293, 294, 297, 303, 307, 308, 309, 311, 315, 316, 318, 330, 335, 336, 338, 345, 346, 349, 350, 351, 360, 362, 384, 391, 412, 415, 416.
Pliocene: 65, 68, 137, 138, 154, 155, 193, 239, 295, 319, 335, 415, 416.
Pleistocene: 4, 13, 65, 206, 208, 239, 279, 280, 306, 319, 385, 386.
Recent: 17, 39, 46a, 52, 53, 62, 72, 76, 92, 93, 117, 123, 169, 189, 191, 198, 230, 232, 258, 278, 279, 280, 292, 319, 335, 365.
Reworked Foraminifera: 1, 76, 202, 206, 284, 357, 365.

GEOGRAPHIC INDEX

(Countries are in alphabetical order)

AFRICA
Algeria: 98, 111, 123, 153, 365.
Angola: 272.
Cyrenaica: 113, 214–216, 226, 245, 273a, 296–302, 358.
Egypt: 43, 75, 91.
Gabon: 120.
Mauretania: 121.
Morocco: 107, 153, 187, 217–219, 284, 285.
Somalia: 211, 212.
Sudan: 120, 122, 388.
Tunisia: 153.
Western Africa: 54

AMERICA
Central America (general): 127, 138, 265, 281.
Cuba: 17, 266.
Guadeloupe: 391.
Mexico: 73, 97, 125, 311, 312, 314–416, 318.
Puerto Rico: 62, 191.
North America (general): 127, 145.
Alabama: 60, 133, 342.
Arkansas: 3, 73.
California: 11, 13, 39, 68, 69, 71, 72, 74, 171, 192, 193, 274.
Carolina: 60
Canada: 116.
Colorado: 325.
Florida: 60, 307.
Georgia: 60.
Kansas: 223.
Louisiana: 3, 129, 134, 155, 160, 161, 303.
Mississippi: 56, 60, 63, 64, 124, 129, 133, 161, 227.
Missouri: 14.
New England: 65.
Oklahoma: 325, 326, 355.
Oregon: 18.
Tennessee: 73.
Texas: 1, 31, 34, 35, 40, 49, 60, 66, 73, 88, 96, 97, 129, 160, 161, 170, 192, 193, 223, 247, 248, 288, 294, 324, 329, 374.
South America
Argentina: 117.
Chile: 114, 244, 317.
Colombia: 89, 275.
Peru: 267.
Trinidad: 66, 125, 126, 127, 199.
Venezuela: 70, 125, 193, 235, 284.

ARCTIC REGIONS: 156, 174, 283.

ASIA
Afghanistan: 30.
Assam: 364.
Burma: 396.
Central Asia: 286, 287, 337, 395.
China: 48, 328.
India: 125, 126, 221, 251, 270, 286, 287, 337, 364, 395, 396.
Indochina: 131, 273, 325, 406.
Iraq-Iran-Persia: 130, 203, 242, 260, 317, 403.
Japan-Formosa: 10, 119, 136–139, 141, 142, 157, 159, 173, 234, 239, 306, 345, 346, 349, 366, 416.
Manchuria: 348, 417.
Syria and Palestine: 21, 22, 42, 95, 130, 317.
Turkey (*Asia Minor*): 47, 130.
Russia (*U.S.S.R. Asiatic*): 208, 252–254, 321, 325, 335, 362, 363, 397, 398, 404, 411, 413, 415, 418, 420.

EUROPE
Austria: 193, 222, 229, 336.
Baltic: 270.
Balkan: 15, 26, 128.
Belgium: 135, 202, 352, 357, 400.
Cyprus: 256.
Czechoslovakia-Bohemia-Carpathians: 105, 165, 166, 176, 180, 238, 291, 304, 317.

Denmark: 213.
England: 146, 192, 193, 317, 385, 386.
France: 16, 19, 76–78, 80, 81, 84, 126, 190, 193, 194, 198, 224, 225, 246, 255, 271, 320, 375, 376, 393, 394, 399, 401, 403, 407, 414.
Germany: 100–102, 106, 183–185, 192, 201, 240, 258, 259, 339–341, 361.
Greece: 195, 237, 327.
Holland: 206
Hungary: 24, 25, 264, 354, 367.
Italy: 5, 6, 112, 193, 196, 233, 236, 250, 284, 285, 295, 317, 327, 372.
Poland: 384.
Roumania: 50, 51, 90, 158, 181, 210, 317, 356, 369, 381, 382.
Russia (*U.S.S.R. and Caucasus*): 2, 4, 23, 87, 208, 288, 317, 362, 397, 398, 411, 413, 415, 418, 421, 425.
Spain (*Baleares and Pyrenees*): 20, 52, 53, 82, 132, 261–263, 269, 290, 293, 353, 390.
Sweden: 29, 209, 317, 331.
Switzerland: 8, 9, 57, 163, 164, 179, 204, 205, 257, 409.

OCEANIA

Australia: 44–46, 46a, 55, 59, 154.
Bali: 169.
Borneo: 32, 307, 317, 350.
Buton: 307.
Celebes: 149.
Java: 125, 126, 150, 169, 307–309, 319, 338, 360.
Madura: 169.
Netherland East Indies (general): 333.
New Zealand: 92, 93, 243, 392, 412.
Pacific Islands (*and Polynesia*): 12, 39, 220, 380, 424.
Sumatra: 308, 351.

OCEANS

Atlantic: 279, 280.
Caribbean: 62, 191.
Indian: 278, 319.
Malay Archipelago: 169, 319.
Mediterranean: 52, 53, 189, 198.
Pacific: 46a, 92, 93, 319, 380, 410.

II. INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEAR 1935[1]

Adhaerentina gen. nov., Paalzow, **240,** p. 28. Generotype: *A. permiana* Paalzow, 1935. Family Hypermminidae. Permian, Germany. (Preoccupied by Spandel, 1909, *Ber. Tätigkeit Offenbacher, Ver. f. Naturkunde,* p. 212, pl. 2, fig. 7; *A. rhenana* Spandel, Middle Oligocene, Germany).

——— *permiana* Paalzow, **240,** p. 29, pl. 3, fig. 3. Permian, Germany.

[1] *Note:* The numbers in bold-face type following the author's name in the Index refer to the publications of the preceding Bibliography.

Ammodiscus borneensis Koch, **175,** p. 557. New name for: *A. irregularis* Koch, 1926, not Grzybowski, 1897. Tertiary, Borneo.

——— *finlayi* Parr, **243,** p. 80, pl. 19, fig. 5. Miocene, New Zealand.

Amphifenestrella gen. nov., Rhumbler, **258,** p. 169. Generotype: *A. wiesneri* Rhumbler, 1935. Fam. Rhabdamminidae, subfam. Astrorhizinae. Recent, Bay of Kiel, Germany.

——— *wiesneri* Rhumbler, **258,** p. 169, text fig. 86. Recent, Bay of Kiel, Germany.

Angulogerina cooperensis Cushman, **60,** p. 42, pl. 16, fig. 9. Upper Eocene, South Carolina, U. S. A.

——— *rugoplicata* Cushman, **64,** p. 33, pl. 5, fig. 5. Lower Oligocene, Mississippi, U.S.A.

——— *vicksburgensis* Cushman, **64,** p. 33, pl. 5, figs. 3, 4. Lower Oligocene, Mississippi, U.S.A.

Anomalina californiensis Cushman and Hobson, **71,** p. 64, pl. 9, fig. 8. Oligocene?, California.

——— *crassisepta* Cushman and Siegfus, **74,** p. 95, pl. 14, fig. 12. Upper Eocene?, Kreyenhagen shales, California.

——— *henbesti* Plummer, **248,** p. 290, pl. 5, figs. 7–10. Upper Cretaceous, Taylor formation, Texas, U.S.A. (For *A. involuta* Cushman, 1931, not Reuss, 1851, and for *A. complanata* Sandidge, 1932, not Reuss, 1851.)

Armorella sphaerica Heron-Allen and Earland, 1932, forma *corniculifera* Rhumbler, **258,** p. 172, text fig. 92. Recent, Bay of Kiel, Germany.

——— ——— Heron-Allen and Earland, 1932, forma *fenestrata* Rhumbler, **258,** p. 172, text fig. 95. Recent, Bay of Kiel, Germany.

——— ——— Heron-Allen and Earland, 1932, forma *lapidaria* Rhumbler, **258,** p. 173, text figs. 100, 101. Recent, Bay of Kiel, Germany.

Armorella sphaerica Heron-Allen and Earland, 1932, forma *ramificans* Rhumbler, **258,** p. 172, text figs. 96–99. Recent, Bay of Kiel, Germany.

——— ——— Heron-Allen and Earland, 1932, forma *unitubulata* Rhumbler, **258,** p. 172, text figs. 93, 94. Recent, Bay of Kiel, Germany.

Astacolus sp.(? n. sp.) Eichenberg, **100,** p. 12, pl. 3, fig. 5. Aptian, northern Germany.

Asterigerina crassaformis Cushman and Siegfus, **74,** p. 94, pl. 14, fig. 10. Upper Eocene?, Kreyenhagen shale, California.

Asterocyclina, see *Discocyclina.*

Astrorhiza vermiculata LeCalvez, **198,** p. 82, text fig. 3. Recent, Mediterranean Sea, 200 m depth.

Baggina xenoula Hadley, **133,** p. 192, pl. 1, fig. 5. Miocene, Mississippi, U.S.A.

Bathysiphon humilis LeCalvez, **198,** p. 85,

text fig. 5. Recent, Mediterranean Sea, 150 m depth.
——— *sp.*(?) Cushman and Hobson, **71,** p. 55, pl. 8, fig. 1. Oligocene?, California.
Bifarina tombigbeensis Hadley, **133,** p. 194, pl. 1, fig. 7. Tertiary, Mississippi, U.S.A.
Bitubulogenerina chickasawhayica Hadley, **133,** p. 190, pl. 1, fig. 3. Miocene, Mississippi, U.S.A.
——— *howei* Cushman, **63,** p. 20, pl. 3, figs. 10–12. Lower Oligocene, Mississippi, U.S.A. (For *Gaudryina* sp. Cushman, 1922, *U. S. Geol. Survey, Prof. Paper* 129-F, p. 127, pl. 29, fig. 6; and for *Bitubulogenerina* sp. Howe, 1934, *Jour. Paleontology*, vol. 8, pl. 51, fig. 4.)
Bolivina cochei Cushman and Adams, **68,** p. 19, pl. 3, figs. 6, 7. Pliocene, California.
——— *cubana* Bermudez, **17,** p. 196, text figs. 2, 3. Recent, North coast, Cuba. (Note: This species is preoccupied by *B. lobata* H. B. Brady, 1881, var. *cubensis* Cushman, 1919. See Editor's note, p. 208.)
——— *garretti* Cushman, **64,** p. 33, pl. 5, fig. 2. Lower Oligocene, Mississippi, U.S.A.
——— *mornhinvegi* Cushman, **64,** p. 32, pl. 5, fig. 1. Lower Oligocene, Mississippi.
——— *sinuata* Galloway and Wissler, 1927, var. *alisoensis* Cushman and Adams, **68,** p. 19, pl. 3, fig. 5. Pliocene, California.
——— *sp.*(?) Cushman and Hobson, **71,** p. 62, pl. 9, fig. 5. Oligocene?, California.
Bolivina subadvena Cushman, 1926, var. *sulphurensis* Cushman and Adams, **68,** p. 20, pl. 3, figs. 8, 9. Pliocene, California.
Bulimina arkadelphiana Cushman and Parker, **73,** p. 96, pl. 15, figs. 1, 2. Cretaceous, Arkadelphia clay, Arkansas, U.S.A.
——— *corrugata* Cushman and Siegfus, **74,** p. 92, pl. 14, fig. 7. Upper Eocene?, Kreyenhagen shale, California.
——— *curtissima* Cushman and Siefgus, **74,** p. 93, pl. 14, fig. 9. Upper Eocene?, Kreyenhagen shale, California.
——— *exigua* Cushman and Parker, **73,** p. 99, pl. 15, fig. 7. Cretaceous, Brownstown marl, Texas.
——— *garzaensis* Cushman and Siegfus, **74,** p. 93, pl. 14, fig. 8. Upper Eocene?, Kreyenhagen shale, California.
——— *ornata* Cushman and Parker, **73,** p. 97, pl. 15, fig. 4. Upper Cretaceous, Taylor formation, Texas. (Preoccupied by Egger, 1893, and therefore changed to *B. rudita* Cushman and Parker, 1936, *Cushman. Lab. Foram. Research, Contr.*, vol. 12, p. 45.)
——— *prolixa* Cushman and Parker, **73,** p. 98, pl. 15, fig. 5. Upper Cretaceous, Selma chalk, Tennessee. (For *Bulimina puschi* Cushman, 1931, not Reuss, 1851, *Tenn. Geol. Survey, Bull.* 41, p. 47, pl. 7, fig. 19.)
——— *reussi* Morrow, 1934, var. *navarroensis* Cushman and Parker, **73,** p. 100, pl. 15, fig. 11. Upper Cretaceous, Navarro formation, Texas.
——— *spinata* Cushman and Campbell, **69,** p. 72, pl. 11, fig. 11. Upper Cretaceous, California.
——— *taylorensis* Cushman and Parker, **73,** p. 96, pl. 15, fig. 3. Upper Cretaceous, upper Taylor formation, Texas.
——— *triangularis* Cushman and Parker, **73,** p. 97, pl. 15, fig. 6. Upper Cretaceous, upper Taylor formation, Texas.

Camerina jacksonensis Gravell and Hanna, **129,** p. 331, pl. 29, figs. 1–5, 7–8, 10, 11, 13, 14. Upper Eocene, Jackson formation, Mississippi, Texas, and Louisiana.
——— *macgillavryi* M. G. Rutten, **266,** p. 530, pl. 59, figs. 6–10, text fig. 4 N. Upper Eocene, Cuba.
——— *malbertii* M. G. Rutten, **266,** p. 531, pl. 60, figs. 8–10, text fig. 2. Upper Eocene, Cuba.
——— *moodybranchensis* Gravell and Hanna, **129,** p. 332, pl. 29, figs. 15, 22–24. Upper Eocene, Jackson formation, Louisiana and Texas.
——— *petri* M. G. Rutten, **266,** p. 530, pl. 59, figs. 1–5, text fig. 2. Upper Eocene, Cuba.
——— sp. M. G. Rutten, **266,** p. 532, pl. 60, figs. 1–4, text fig. 3. Upper Eocene, Cuba. (For *Amphistegina cubensis* Palmer, 1934, *Soc. cubana hist. nat., Mem.* 8, no. 4, p. 256, pl. 15, fig. 2, text figs. 16, 17.)
Carpenteria carolinensis Cushman, **60,** p. 55, pl. 23, fig. 8. Upper Eocene, North Carolina.
Cassidulina crassipunctata Cushman and Hobson, **71,** p. 63, pl. 9, fig. 10. Oligocene?, California.
Choffatella n. sp. Renz, **257,** p. 196. Oxfordian-Argovian, Mytilus-beds, Prealpes, Switzerland. (No figure, only short diagnostic description.)
——— nov. spec. Leupold and Maync, **205,** p. 137. Oxfordian-Argovian, Klippen-Overthrust, Swiss Alps. (No description, no figure.)
Cibicides mississippiensis (Cushman, 1922) var. *ocalana* Cushman, **60,** p. 56. Upper Eocene, Georgia. (Only description, no figure.)
——— *pseudoungerianus* (Cushman, 1922) var. *evoluta* Cushman and Hobson, **71,** p. 64, pl. 9, fig. 11. Oligocene?, California.
——— *venezuelana* Nuttall, **235,** p. 131, pl. 15, figs. 25–27. Upper Eocene, Venezuela.
Clavulina serventyi Chapman and Parr, **46a,** p. 5, pl. 1, fig. 7. Recent, off Australia, 70 fathoms.
——— *venezuelana* Nuttall, **235,** p. 123, pl. 14, fig. 9. Upper Eocene, Venezuela.
Cornuspira byramensis Cushman, **64,** p 27, pl. 4, fig. 4. Lower Oligocene, Mississippi.
——— *spandeli* Paalzow, **240,** p. 32, pl. 3, fig. 7. Permian, Germany.
Coscinoconus gen. nov. Leupold, **204,** p. 610. Generotype: *C. alpinus* Leupold, 1935.

Fam. probably Rotaliidae, subfam. probably Turrispirillininae. Jurassic-Cretaceous bounday, Swiss Alps.

——— *alpinus* Leupold, **204,** p. 610, pl. 18, figs. 1–11. Transition beds, Upper Jurassic to Lower Cretaceous, Swiss Alps.

——— *elongatus* Leupold, **204,** p. 617, pl. 18, figs. 12–14. Lower Cretaceous, Berriasian, Swiss Alps.

Coskinolina sp. Chapman and Crespin, **46,** p. 57, pl. 3 (not pl. 1), fig. 1. Middle to upper Eocene, Western Australia.

Cribrogoësella gen. nov., Cushman, **62,** p. 4. Generotype: *Bigenerina robusta* H. B. Brady, 1884. Fam. Valvulinidae. Recent, West Indies.

——— *bradyi* Cushman, **62,** p. 4, pl. 1, figs. 10, 11. Recent, off north of Puerto Rico, 350–400 fathoms. (For *Textularia agglutinans* pars, H. B. Brady, 1884, not d'Orbigny, 1839, *Challenger Rept., Zoology*, vol. 9, pl. 43, fig. 12, not figs. 1–3.)

Cryptasterorbis subgen. nov., M. G. Rutten, **266,** p. 533. New subgenus of *Lepidorbitoides* Silvestri, 1909. Subgenerotype: *?Asterorbis cubensis* Palmer, 1934. Fam. Orbitoididae, subfam. Lepidorbitoidinae. Upper Cretaceous, Cuba.

Cyclammina formosensis Yabe and Hanzawa, in Hanzawa, **138,** new name for *Cyclammina complanata* Yabe and Hanzawa, 1930 (not Chapman), p. 13. Lower Miocene, Formosa.

——— *medwayensis* Parr, **243,** p. 81, text fig. 1, pl. 19, fig. 6. Miocene, New Zealand.

Dentalina n. sp. Eichenberg, **100,** p. 16, pl. 1, fig. 14. Aptian, northern Germany.

?——— n. sp. Eichenberg, **100,** p. 19, pl. 2, fig. 5. Aptian, northern Germany.

——— n. sp Eichenberg, **100,** p. 20, pl. 2, fig. 18. Aptian, northern Germany.

——— sp.? Cushman, **60,** p. 21, pl. 8, figs. 15, 16. Upper Eocene, South Carolina.

——— sp. Eichenberg, **101,** p. 393, pl. 1, fig. 8. Upper Albian, Germany.

——— sp. Eichenberg, **100,** p. 13, pl. 1, fig. 1; p. 16, pl. 1, fig. 12; p. 19, pl. 2, fig. 6; p. 19, pl. 2, fig. 7; p. 21, pl. 2, fig. 19; p. 21, pl. 2, fig. 21; p. 21, pl. 5, fig. 10. Seven different species, all from Aptian, northern Germany.

——— *striatella* Paalzow, **240,** p. 38, pl. 4, fig. 24. Permian, Germany.

Discocyclina n. sp. Yabe and Hanzawa, in Hayasaka, **141,** p. 329, text fig. Eocene, Taiwan.

——— sp. A Gravell and Hanna, **129,** p. 335, pl. 32, figs. 5–10. Upper Eocene, Louisiana and Mississippi.

——— sp. B Gravell and Hanna, **129,** p. 326, pl. 32, fig. 13. Upper Eocene, Jackson formation, Texas.

——— (*Asterocyclina*) sp. M. G. Rutten, **266,** p. 542, pl. 62, fig. 6. Upper Eocene, Cuba.

——— (*Asterocyclina*) *vermunti* M. G. Rutten, **266,** p. 542, pl. 61, figs. 4, 5; pl. 62, fig. 7. Upper Eocene, Cuba.

Discorbinella gen. nov., Cushman and Martin, **72,** p. 89. Generotype: *D. montereyensis* Cushman and Martin, 1935, Fam. Rotaliidae. Recent, Monterey Bay, California, 41 fathoms.

——— *montereyensis* Cushman and Martin, **72,** p. 89, pl. 14, fig. 13. Recent, Monterey Bay, California, 41 fathoms.

Discorbis aguayoi Bermúdez, **17,** p. 204, pl. 15, figs. 10–14. Recent, north coast, Cuba.

——— *arcuato-costatus* Cushman, **64,** p. 38, pl. 5, fig. 9. Lower Oligocene, Mississippi.

——— *mirandensis* Nuttall, **235,** p. 128, pl. 15, figs. 7–9. Upper Eocene, Venezuela.

——— *orbicularis* (Terquem, 1876) var. *antillea* Bermúdez, **17,** p. 205, pl. 16, figs. 11–13. Recent, north coast, Cuba.

——— *palmerae* Bermúdez, **17,** p. 207, pl. 14, figs. 4–7. Recent, north coast, Cuba.

——— sp. A Bermúdez, **17,** p. 208, pl. 15, figs. 6, 7. Recent, north coast, Cuba.

——— sp. B Bermúdez, **17,** p. 208, pl. 15, figs. 8, 9. Recent, north coast, Cuba.

——— *subglobosus* Cushman, **64,** p. 38, pl. 5, fig. 8. Lower Oligocene, Mississippi.

——— *torrei* Bermúdez, **117,** p. 206, pl. 16, figs. 1–4. Recent, north coast, Cuba.

Doliolina douvillei Gubler, **131,** p. 100, pl. 4, figs. 1, 2; pl. 5, fig. 16. Permian, Indochina. (Incorrectly spelled *Dioliolina.*)

——— *dunbari* Gubler, **131,** p. 102, pl. 5, figs. 7, 9. Permian, Indochina.

Doliolininae subfam. nov., Gubler, **131,** p. 9, 56, 58. New subfamily of the Fam. Fusulinidae. (Comprises the genera *Doliolina* Schellwien, 1902; *Verbeekina* Staff, 1909; *Neoschwagerina* Yabe, 1930; *Sumatrina* Volz, 1904.) Permian.

Echinofolliculina gen. nov., Dons, **92,** p. 28. Generotype: *E. mortensi* Dons, 1935, Recent, Pacific Ocean, New Zealand. (Cited from: *Zool. Rec.*, vol. 17, 1935, Protozoa, p. 78.)

——— *mortensi* Dons, **92,** p. 28, with description and figures. Recent, Pacific Ocean, New Zealand. (Cited as above.)

Ehrenbergina spinea Cushman, **62,** p. 8, pl. 3, figs. 10, 11. Recent, off north of Puerto Rico, 200 to 300 fathoms.

Ellipsoglandulina bensoni Parr, **243,** p. 78, pl. 19, fig. 2. Miocene New Zealand. (For *Dentalina gümbeli* Hantken, 1876, not Schwager, 1865, *Magy. kir. földt, int. evkönyve*, vol. 4, p. 32, pl. 4, fig. 1.)

Elphidium georgianum Cushman, **65,** p. 79, pl. 12, fig. 5. Late Tertiary, New England.

——— *morenoi* Bermúdez, **17,** p. 188, pl. 13, figs. 7–9. Recent, north coast, Cuba.

——— *schreiteri* Eichenberg, **101,** p. 398, pl. 13, fig. 11. Basal Hauterivian, North Germany.

Entosolenia byramensis Cushman, **64,** p. 31, pl. 4, fig. 10. Lower Oligocene, Mississippi.
——— *contorta* Campbell, **39,** p. 47, text fig. xi. Recent, California.
——— *crumenata* Cushman, **64,** p. 31, pl. 4, fig. 9. Lower Oligocene, Mississippi.
Eponidella gen. nov., Cushman and Hedberg, **70,** p. 14. Generotype: *E. libertadensis* Cushman and Hedberg, 1935. Fam. Rotaliidae. Miocene, Venezuela.
——— *cushmani* Stephenson, **303,** p. 189, pl. 5, figs. 17–19. Upper Miocene, Louisiana.
——— *libertadensis* Cushman and Hedberg, **70,** p. 14, pl. 3, figs. 1–4. Miocene, Venezuela.
Eponides bolivarensis Nuttall, **235,** p. 129, pl. 15, figs. 12–14. Upper Eocene, Venezuela.
——— *budensis* (Hantken, 1876) var. *planata* Cushman, **60,** p. 47, pl. 18, fig. 6. Upper Eocene, North Carolina.
——— *carolinensis* Cushman, **60,** p. 46, pl. 17, fig. 7. Upper Eocene, North Carolina.

Flabellina jarvisi Cushman, **66,** p. 85, pl. 13, figs. 7, 8. Upper Cretaceous, Trinidad. (For *F. interpunctata* Cushman and Jarvis, 1932, not von der Marck, 1858.)
——— *pilulifera* Cushman and Campbell, **69,** p. 67, pl. 10, fig. 6. Upper Cretaceous, California.
——— *suturalis* Cushman, **66,** p. 86, pl. 13, figs. 9–18. Upper Cretaceous, Taylor formation, Texas. (*For F. rugosa* Heron-Allen and Earland, 1910, not d'Orbigny, 1840, *Royal Micr. Soc., Jour.*, p. 422, pl. 8, fig. 7.)
Flabellinella liebusi Jedlitschka, **166,** p. 10, text fig. 18 Eocene, Bartonian, Czechoslovakia.
Flintia laticoncava Cushman, **64,** p. 26, pl. 4, fig. 3. Lower Oligocene, Mississippi.
Frondicularia bulonganensis Koch, **175,** p. 558. Tertiary, Borneo. (New name for *F. costata* Koch, 1926, not Kübler and Zwingli, 1866.)
——— *draco* Paalzow, **240,** p. 43, pl. 5, fig. 9. Permian, Germany.
——— *garretti* Cushman, **64,** p. 28, pl. 4, fig. 8. Lower Oligocene, Mississippi.
——— *minutissima* Paalzow, **240,** p. 43, pl. 5, fig. 8. Permian, Germany.
——— *seminiformis* Cushman and Campbell, **69,** p. 70, pl. 9, fig. 5. Upper Cretaceous, California. (For *Frondicularia* sp.?, Cushman, 1926, *Am. Assoc. Petroleum Geologists, Bull.*, vol. 10, p. 598, pl. 20, fig. 4.)
——— sp.(?) Cushman and Campbell, **69,** p. 70, pl. 11, fig. 6. Upper Cretaceous, California.
Fusulina uralica Krotow, 1898, var. *robusta* Silvestri, **286,** p. 91, pl. 1, fig. 1. Upper Uralian, Zug Shaksgam Valley, Caracorum.
Fusulinella fittsi Thompson, **326,** p. 300, pl. 26, figs. 1–6. Lower Pennsylvanian, Oklahoma.
——— *oliviformis* Thompson, **326,** p. 299, pl. 26, figs. 10–13. Lower Pennsylvanian, Oklahoma. (For *?Schubertella transitoria* Galloway and Ryniker, 1930, not Staff and Wedekind, 1910, *Oklahoma Geol. Survey, Circ.* 21, p. 23, pl. 5, figs. 1–5.)
——— *prolifica* Thompson, **326,** p. 302, pl. 26, figs. 23–29. Lower Pennsylvanian, Oklahoma.
——— sp. Gubler, **131,** p. 78, pl. 4, fig. 13. Permian, Indochina.
——— *trisulcata* Thompson, **326,** p. 303, pl. 26, figs. 20–23. Lower Pennsylvanian, Oklahoma.

Gaudryina (*Siphogaudryina*) *compressa* Cushman, **62,** p. 3, pl. 1, fig. 9. Recent, off north of Puerto Rico, 80 to 120 fathoms.
——— *kingi* Parr, **243,** p. 83, pl. 20, fig. 1. Miocene, New Zealand.
——— *koimetercola* Hadley, **133,** p. 189, pl. 1, fig. 1. Oligocene, Mississippi.
——— *medwayensis* Parr, **243,** p. 83, pl. 20, fig. 2. Miocene, New Zealand.
——— *navarroana* Cushman, 1932, var. *crassaformis* Cushman and Campbell, **69,** p. 66, pl. 10, fig. 1. Upper Cretaceous, California.
Glandulina basi-spinata Cushman, **65,** p. 78, pl. 12, figs. 6–8. Late Tertiary, New England.
——— *spinata* Cushman, **62,** p. 8, pl. 3, figs. 8, 9. Recent, off north of Puerto Rico, 17 fathoms.
Globigerina binaiensis Koch, **175,** p. 558. Middle Tertiary, Borneo. (New name for *G. aspera* Koch, 1926, not Ehrenberg, 1854.)
Goësella conversa Jedlitschka, **166,** p. 8, text figs. 5–7. Eocene, Bartonian, Czechoslovakia.
Gordiospira rugosa Cushman, **62,** p. 7, pl. 3, figs. 5–7. Recent, off north of Puerto Rico, 80 to 120 fathoms.
Gümbelina venezuelana Nuttall, **235,** p. 126, pl. 15, figs. 2–4. Upper Eocene, Venezuela.
Guttulina georgiana Cushman, **65,** p. 78, pl. 12, fig. 4. Late Tertiary, New England.
Gyroidina orbicularis d'Orbigny, 1826, var. *planata* Cushman, **60,** p. 45, pl. 18, fig. 3. Upper Eocene, South Carolina.

Haddonia sp. Bermúdez, **17,** p. 178, text fig. 1. Recent, north coast, Cuba.
Haeuslerella gen. nov., Parr, **243,** p. 82. Generotype: *H. pukeuriensis* Parr, 1935. Fam. Textulariidae, subfam. Textulariinae. Miocene, Awamoan, Pukeuri, New Zealand.
——— *pukeuriensis* Parr, **243,** p. 83, pl. 19, fig. 7. Miocene, New Zealand.
Hauerina howelli Bermúdez, **17,** p. 166, pl. 12, figs. 6, 7. Recent, north coast, Cuba.
Heronallenia vicksburgensis Cushman, **64,** p. 38, pl. 5, fig. 11. Lower Oligocene, Mississippi.
Hippocrepinella ampullacea Rhumbler, **258,** p. 156, text figs. 46, 47. Recent, Bay of Kiel, Germany.

——— *remanei* Rhumbler, **258,** p. 151, text figs. 20–42. Recent, Bay of Kiel, Germany. This species consists of the following new forms:
——— ——— Rhumbler, forma *anulata* Rhumbler, **258,** p. 154, text fig. 40.
——— ——— Rhumbler forma *gibbera* Rhumbler, **258,** p. 153, text figs. 32–37.
——— ——— Rhumbler, forma *irregularis* Rhumbler, **258,** p. 154, text figs. 41, 42.
——— ——— Rhumbler, forma *oblonga* Rhumbler, **258,** p. 153, text figs. 25–31.
——— ——— Rhumbler forma *sphaerica* Rhumbler, **258,** p. 152, text figs. 20–24.
——— ——— Rhumbler, forma *vulcanalis* Rhumbler, **258,** p. 154, text figs. 38, 39.
——— *virgulata* Rhumbler, **258,** p. 155, text fig. 45. Recent, Bay of Kiel, Germany.
Hyperammina compressa Paalzow, **240,** p. 28, pl. 3, figs. 1, 2. Permian, Germany.

Involutininae subfam. nov., Thalmann, **313,** p. 715. New subfamily of the family Lituolidae. (For Silicininae Cushman, 1933, not Earland, 1933. Comprises the genera *Silicinina* Bornemann, 1874; *Involutina* Terquem, 1862; and *Problematina* Bornemann, 1874.)
Iridia serialis LeCalvez, **198,** p. 91, text fig. ix. Recent, Mediterranean Sea, 2 to 20 m.
Isorbitoina subgen. nov., van de Geyn and van der Vlerk, **127,** p. 227. New subgenus of genus *Orbitoina* van de Geyn and van der Vlerk, 1935. Subgenerotype: *Lepidocyclina* (*Lepidocyclina*) *trinitatis* H. Douvillé, 1924. Fam. Orbitoididae. Eocene.

Kilianina gen. nov., Pfender, **246,** p. 245. Generotype: *K. blancheti* Pfender, 1935. Fam. Orbitolinidae. Jurassic, Bathonian, French Alps.
——— *blancheti* Pfender, **246,** p. 245, pl. 1, figs. a–k; pl. 2, figs. 1–3, text figs. 1–3. Jurassic, Bathonian, High Alps, France.

Lagena sp.? Cushman, **60,** p. 23, pl. 9, fig. 11. Upper Eocene, South Carolina.
Lenticulina, n. sp. Eichenberg, **101,** p. 394, pl. 3, fig. 7. Lower Albian, northern Germany.
——— n. sp. Eichenberg, **101,** p. 396, pl. 6, Germanicus-Zone fig. 3. Barremian, northern Germany.
——— n. sp. 1 Eichenberg, **101,** p. 396, pl. 8, fig. 4. Upper Neocomian, northern Germany.
——— n. sp. 2 Eichenberg, **101,** p. 396, pl. 8, fig. 6. Upper Neocomian, northern Germany.
Lepidocyclina (*Trybliolepidina*) *elegans* Tan Sin Hok, **309,** pp. 13, 18, pl. 4, figs 10–12. Miocene, western Java.
——— (*Nephrolepidina*) *lehneri* van de Geyn and van der Vlerk, **127,** p. 271, text figs. 14, 15. Oligocene, Trinidad. (Includes *L. sumatrensis* Cushman, 1920, not Brady, 1878, *U. S. Geol. Survey, Prof. Paper* 125-D, p. 76, pl. 33, figs. 10, 11, Oligocene of Curacoa and Cuba.)
——— *omphalus* Tan Sin Hok, **309,** p. 11, pl. 1, figs. 4–8; pl. 2, figs. 1–10; pl. 3, figs. 1–9; pl. 4, figs. 2–9. B form. Miocene, western Java. (Includes *Lepidocyclina mantelli* Scheffen 1932, not Morton, 1833, *Dienst Mijnbouw Ned.-Indië, Wetensch. Mededeel.*, no. 21, p. 50, pl. 1, fig. 1.)
——— (*Nephrolepidina*) *petri* M. G. Rutten, **266,** p. 539. For *Lepidocyclina piedrasensis* Vaughan, in Rutten, 1935, *Jour. Paleontology*, vol. 9, p. 539, pl. 61, figs. 1, 7; pl. 62, figs. 8, 9. Upper Eocene and Oligocene of Santa Clara province, Cuba.
——— *stratifera* Tan Sin Hok, **309,** p. 10, pl. 1, figs. 1–3; pl. 2, fig. 11; pl. 3, fig. 9; pl. 4, fig. 1. Miocene, Middle Java. (B-form.)
Lepidorbitoides (*Lepidorbitoides*) *planasi* M. G. Rutten, **266,** p. 536, pl. 60, figs. 6, 7, text fig. 4 P. Upper Cretaceous (not upper Eocene as given on p. 537), Cuba.
Leptodermella gen. nov., Rhumbler, **258,** p. 178. Generotype: *Pseudarcella arenata*, Cushman, 1930 (not *Pseudarcella* Spandel, 1909), *Florida Geol. Survey, Bull.* 4, p. 15, pl. 1, fig. 3. Fam. Rhabdamminidae. Subfam. Saccammininae. Miocene, Florida. Recent, Bay of Kiel, Germany.
——— *turbanica* Rhumbler, **258,** p. 178, text figs. 117 a–c. Recent, Bay of Kiel, Germany.
Lingulina articulata Paalzow, **240,** p. 41, pl. 4, fig. 38; pl. 5, fig. 3. Permian, Germany.
——— *clavata* Paalzow, **240,** p. 42, pl. 5, fig. 5. Permian, Germany.
——— *linguaeformis* Paalzow, **240,** p. 41, pl. 5, figs. 1, 2. Permian Germany.
——— *permo-striata* Paalzow, **240,** p. 42, pl. 5, fig. 6. Permian, Germany.
——— *pulchra* Paalzow, **240,** p. 42, pl. 5, fig. 4. Permian, Germany.
——— *spandeli* Paalzow, **240,** p. 41, pl. 4, figs. 35–37. Permian, Germany.
Listerella nodulosa (Cushman, 1922) var. *glabrata* Cushman, **65,** p. 77, pl. 12, fig. 1. Late Tertiary, New England.
Loxostomum georgianum Cushman, **65,** p. 81, pl. 12, figs. 14, 15. Late Tertiary, New England.
Lunucammina elongata Paalzow, **240,** p. 34, pl. 4, figs. 2, 3. Permian, Germany.

Marginulina cocoaensis Cushman, 1925, var. *venezuelana* Nuttall, **235,** p. 125, pl. 14, fig. 13. Upper Eocene, Venezuela.
——— *georgiana* Cushman, **65,** p. 77, pl. 12, figs. 2, 3. Late Tertiary, New England.
——— *karreriana* Cushman, **65,** p. 18, pl. 7, figs. 1, 2. Upper Eocene, South Carolina. (For *Marginulina abbreviata* Karrer, 1862, not Neugeboren, 1851, *Akad. Wiss. Wien, Sitzber.*, vol. 44, pt. 1, p. 445, pl. 1, fig. 7.)

——— sp.(?) Cushman and Hobson, **71,** p. 58, pl. 8, figs. 12–14. Oligocene?, California.
——— *striato-carinata* Cushman and Campbell, **69,** p. 67, pl. 10, figs. 4, 7. Upper Cretaceous, California.
——— *tobleri* Koch, **175,** p. 558. Middle Tertiary, Borneo. New name for *Marginulina gracilis* Koch, 1926, not Cornuel, 1848.
Massilina agglutinans Keijzer, **169,** p. 120, text figs. 18, 19. Recent, north coast of Java.
——— *cookei* Cushman, **60,** p. 13, pl. 3, fig. 17. Upper Eocene, Mississippi.
——— *glabricostata* Cushman, **64,** p. 25, pl. 4, fig. 2. Lower Oligocene, Mississippi.
——— *goniopleura* Hadley, **133,** p. 189, pl. 1, fig. 2. Upper Eocene, Mississippi.
Meandroloculina gen. nov., Bogdanovic, **23,** p. 695. Generotype: *M. bogatschovi* Bogdanovic, 1935. Fam. Opthalmidiidae. Miocene, lower Sarmatian, Transcaucasus, Grusia.
——— *bogatschovi* Bogdanovic, **23,** p. 695, text figs. 1–5. Miocene, lower Sarmatian near Tiflis, Grusia.

Nanicella gen. nov., Henbest, **145,** p. 34. Generotype: *Endothyra gallowayi* Thomas, 1931. Fam. Lituolidae. Devonian, U.S.A.
Neoschwagerina elongata Gubler, **131,** p. 108, pl. 8, figs. 1, 2, 5, 12, text fig. 46. Permian, Indochina.
——— *megasphaerica* Deprat, 1913, var. *gigantea* Gubler, **131,** p. 116, pl. 3, figs. 6–8. Permian, Indochina.
——— *sumatrinaeformis* Gubler, **131,** p. 123, pl. 5, figs. 3, 4, 10, 17; pl. 7, fig. 2; text figs. 51, 52. Permian, Indochina.
Nephrolepidina see *Lepidocyclina.*
Nodobacularia n. sp. Kuhn, **103,** p. 111, pl. 9, fig. 30. Lower Jurassic, Dogger, Franconia, Germany.
Nodogenerina georgiana Cushman, **65,** p. 80, pl. 12, fig. 16. Late Tertiary, New England.
Nodosaria conico-densestriata Paalzow, **240,** p. 38, pl. 4, figs. 21–23. Permian, Germany.
——— *cushmani* Paalzow, **240,** p. 37, pl. 4, fig. 16. Permian, Germany. (This species should not be confused with *Dentalina cushmani* Paalzow, 1931.)
——— n. sp. 1 Eichenberg, **100,** p. 21, pl. 1, fig. 9. Aptian, northern Germany.
——— n. sp. 2 Eichenberg, **100,** p. 21, pl. 1, fig. 10. Aptian, northern Germany.
——— n. sp. 3 Eichenberg, **100,** p. 22, pl. 2, fig. 1. Aptian, northern Germany.
——— n. sp. 4 Eichenberg, **100,** p. 23, pl. 2, fig. 2. Aptian, northern Germany.
——— n. sp. 6 Eichenberg, **100,** p. 23, pl. 2, fig. 16. Aptian, northern Germany. (Note: There is no n. sp. 5 published in Eichenberg's paper.)
——— n. sp. 7 Eichenberg, **100,** p. 24, pl. 6, fig. 10. Aptian, northern Germany.
——— sp.(?) Cushman and Campbell, **69,** p. 71, pl. 20, fig. 1. Upper Cretaceous, California.
——— sp.(?) Cushman and Campbell, **69,** p. 72, pl. 11, fig. 2. Upper Cretaceous, California.
——— *spinifera* Cushman and Campbell, **69,** p. 71, pl. 10, figs. 9, 10. Upper Cretaceous, California.
——— *thuringica* Paalzow, **240,** p. 37, pl. 4, fig. 16. Permian, Germany.
Nonionella crassipunctata Cushman, **64,** p. 31, pl. 4, fig. 11. Lower Oligocene, Mississippi.
——— *pauciloba* Cushman, **64,** p. 32, pl. 4, fig. 12. Lower Oligocene, Mississippi.
Nouria johnsoni Cushman, **62,** p. 2, pl. 1, figs. 5, 6. Recent, off north of Puerto Rico, 240 to 300 fathoms.

Omphalocyclus sp. M. G. Rutten, **266,** p. 542, pl. 61, fig. 2. Upper Cretaceous, Cuba.
Operculina complanata (Defrance, 1822) var. *japonica* Hanzawa, **138,** p. 19, pl. 1, figs. 4–28. Miocene, Japan. (Includes *O. complanta* (Defrance) in Yabe, 1918, *Tohoku Imp. Univ., Sci. Rept.*, 2d ser., vol. 4, p. 120, pl. 17, figs. 1–7.)
——— *tuxpanensis* Thalmann, **318,** p. 603, text figs. *a, b.* Miocene, Tuxpan formation, eastern Mexico.
Operculinoides gen. nov., Hanzawa, **138,** p. 18. Generotype: *Nummulites willcoxi* Heilprin, 1882. Fam. Camerinidae, Eocene to Miocene, North, South and Central America.
Orbitoina gen. nov., van de Geyn and van der Vlerk, **127,** p. 227. (Includes the Eocene Lepidocyclinae of the four-stolon group.) Fam. Orbitoididiidae. Eocene. (No generotype mentioned.)
Orthokarstenia gen. nov., Dietrich, **89,** p. 80. Generotype: *Orthocerina ewaldi* Karsten, 1856. Fam. Heterohelicidae. Upper Cretaceous, Colombia, S. A.
Ozawainella gen. nov., Thompson, **325,** p. 114. Generotype: *Fusulinella angulata* Colani, 1924, *Indochine Service géol.*, Mém., vol. 11, fasc. 1, pp. 74, 132, pl. 2, figs. 16–18, 20, 21, 26, 35. Fam. Fusulinidae. Permian, Indochina.

Parafusulina deliciasensis Dunbar and Skinner, **97,** p. 179, pl. 1, figs. 1–9. Middle Permian, Coahuila, Mexico.
——— *kingorum* Dunbar and Skinner, **97,** p. 183, pl. 3, figs. 1–7. Permian, Texas.
——— *rothi* Dunbar and Skinner, **97,** p. 181, pl. 2, figs. 1–8. Permian, Texas.
Pegidia corrugata Cushman, **62,** p. 8, pl. 3, figs. 12, 13. Recent, off north of Puerto Rico, 33 to 40 fathoms.
Physalidia earlandi Bermúdez, **17,** p. 212, pl. 14, figs. 1–3. Recent, north coast, Cuba.
Pilalla gen. nov., Rhumbler, **250,** p. 150. Generotype: *P. exigua* Rhumbler, 1935.

Fam. Rhabdamminidae, subfam. Allogromiinae. Recent, Bay of Kiel, Germany.

——— *exigua* Rhumbler, **258,** p. 150, text figs. 15–19. Recent, Bay of Kiel, Germany.

Planulina venezuelana Nuttall, **235,** p. 130, pl. 15, figs. 23, 24. Upper Eocene, Venezuela.

Planispirina mornhinvegi Cushman, **64,** p. 27, pl. 4, fig. 6. Lower Oligocene, Mississippi.

Plectina conversa Jedlitschka, **166,** p. 8, text figs. 1, 2, 4, 8. Eocene, Bartonian, Czechoslovakia.

—— *garzaensis* Cushman and Siegfus, **74,** p. 92, pl. 14, figs. 3, 4. Upper Eocene?, Kreyenhagen shale, California.

Plectofrondicularia angusti-costata Cushman, **65,** p. 80, pl. 12, fig. 12. Late Tertiary, New England.

——— *basi-spinata* Cushman, **65,** p. 79, pl. 12, fig. 11. Late Tertiary, New England.

——— *georgiana* Cushman, **65,** p. 79, pl. 12, fig. 13. Late Tertiary, New England.

Pliorbitoina subgen. nov., van de Geyn and van der Vlerk, **127,** p. 227. New subgenus of *Orbitoina* van de Geyn and van der Vlerk, 1935. Subgenerotype: *Lepidocyclina* (*Pliolepidina*) *tobleri* H. Douvillé, 1917. Fam. Orbitoididae. Eocene.

?Polymorphina, n. sp. Eichenberg, **100,** p. 29, pl. 6, fig. 2. Aptian, northern Germany.

Polyorbitoidina sugben. nov., van de Geyn and van der Vlerk, **127,** p. 227. New subgenus of *Orbitoidina* van de Geyn and van der Vlerk, 1935. Subgenerotype: *Lepidocyclina* (*Polylepidina*) *proteiformis*, Vaughan, 1924. Fam. Orbitoididae. Eocene.

Proteonina longicollis Wiesner, 1931, forma *minor* Rhumbler, **258,** p. 180, text figs. 121–123. Recent, Bay of Kiel, Germany.

Psammela gen. nov., Rhumbler, **258,** p. 167. Generotype: *P. frankei* Rhumbler, 1935. Fam. Rhabdamminidae, subfam. Astrorhizinae. Recent, Bay of Kiel, Germany.

———*frankei* Rhumbler, **258,** p. 167, text figs. 73–79. Recent, Bay of Kiel, Germany.

——— ——— Rhumbler, forma *sphaeroides* Rhumbler, **258,** p. 168, text figs. 73–75. Recent, Bay of Kiel, Germany.

——— ——— Rhumbler, forma *ellipsoides* Rhumbler, **258,** p. 168, text figs. 76–79. Recent, Bay of Kiel, Germany.

Psammosphaera fusca E. F. Schulze, 1875, forma *adhaerens* Rhumbler, **258,** p. 177, text figs. 112, 113. Recent, Bay of Kiel, Germany.

——— ——— E. F. Schulze, forma *asperrima* Rhumbler, **258,** p. 176, text figs. 110, 111. Recent, Bay of Kiel, Germany.

——— ——— E. F. Schulze, forma *tapetifera* Rhumbler, **258,** p. 176, text fig. 109. Recent, Bay of Kiel, Germany.

Pseudoclavulina sp.? Cushman, **60,** p. 10, pl. 2, fig. 10. Upper Eocene, South Carolina. (For *Clavulina nodosaria* d'Orbigny, 1839, var. *novangliae* Cushman, 1922, *U. S. Nat. Mus, Bull.* 104, pt. 3, p. 82, pl. 15, figs. 3–5.) (Note: This new generic name is mentioned as "*Pseudoclavulina* Cushman 1934," which is incorrect, as it was not described as such before 1936.)

Pseudofusulina ambigua (Deprat, 1913) var. *pursatensis* Gubler, **131,** p. 83, pl. 1, fig. 8; pl. 2, fig. 10; text figs. 38, 39. Permian, Indochina.

——— *cambodgiensis* Gubler, **131,** p. 86, pl. 3, figs. 2, 3; text fig. 40. Permian, Indochina. (For *Fusulina exilis* Deprat, 1912, *Indochine Service géol., Mém.*, vol. 1, pt. 3, p. 24, pl. 7, fig. 16; pl. 8, figs. 13, 14.)

——— *globularis* Gubler, **131,** p. 87, pl. 1, figs. 1, 2, 7; pl. 2, fig. 1; text figs. 41, 42. Permian, Indochina.

——— *lutugini* (Schellwien, 1908) var. *fragilis* Rauser-Černoussova, **253,** pp. 145, 151, pl. 1, fig. 6. Lower Permian, western slope of Ural Mountains. [Note: This variety is preoccupied by *P. chihsiaensis* (Lee, 1931) var. *fragilis* Chen, 1934.]

——— *tchussovensis* Rauser-Černoussova, **253,** pp. 146, 151, pl. 2, figs. 1–5. Lower, Permian, western slope of Ural Mountains.

Pseudorbitoidinae subfam. nov., M. G. Rutten, **266,** p. 544. New subfamily of Orbitoididae. Upper Cretaceous.

Pulvinulinella harrisi Hadley, **133,** p. 193, pl. 1, fig. 6. Upper Eocene, Mississippi.

——— *tenuicarinata* Cushman and Siegfus, **74,** p. 95, pl. 14, fig. 11. Upper Eocene?, Kreyenhagen shale, California.

Pyrgo fornasinii Chapman and Parr, **46a,** p. 86. (For *Biloculina bradyi* Schlumberger, 1891, not Fornasini, 1886, *Zool. Soc. France, Mém.*, vol. 4, p. 170, pl. 10, figs. 63–71, text figs. 15–19, and for *Biloculina ringens* H. B. Brady, 1884, not Lamarck, *Challenger Rept., Zoology*, vol. 9, p. 142, pl. 2, fig. 7.) Recent, off Western Australia.

——— *johnsoni* Cushman, **62,** p. 6, pl. 2, figs. 6–8. Recent, off north of Puerto Rico, 33 to 40 fathoms.

——— *jugosus* Cushman, **62,** p. 6, pl. 2, figs. 9–11. Recent, off north of Puerto Rico, 80 to 120 fathoms.

——— *nasutus* Cushman, **62,** p. 7, pl. 3, figs. 1–4. Recent, off north of Puerto Rico, 17 fathoms.

——— *oligocenica* Cushman, **64,** p. 26, pl. 4, fig. 5. Lower Oligocene, Mississippi.

?Quinqueloculina barbouri Bermúdez, **17,** p. 156, pl. 13, figs. 4–6. Recent, north coast, Cuba.

Reophax, n. sp. Eichenberg, **100,** p. 3, pl. 6, fig. 8. Aptian, northern Germany.

——— sp. Bermúdez, **17,** p. 149, pl. 10, figs. 1, 2. Recent, north coast, Cuba.

——— sp. (?n. sp.) Eichenberg, **100,** p. 3, pl. 7, fig. 1. Aptian, northern Germany.
——— *trilateralis* Cushman, **62,** p. 2, pl. 1, figs. 1–4. Recent, off north of Puerto Rico, 200 to 300 fathoms.
Rhabdammina inaequalis LeCalvez, **198,** p. 83, text fig. iv. Recent, Mediterranean Sea. (For *Rhabdammina linearis* Lacroix, 1928, not H. B. Brady, 1879, *Inst. Océanogr. Monaco, Bull.* 527, p. 5, text figs. 2, 3, and for *R. pseudolinearis* Lacroix, 1928, ibid., p. 6, text fig. 4.)
Rhizammina algaeformis H. B Brady, 1879, forma *nuda* Rhumbler, **258,** p. 182, text fig. 126. Recent, Bay of Kiel, Germany. (For *R. algaeformis* Cushman, 1910, not Brady, 1879, *U. S. Nat. Mus., Bull.* 71, p. 34, text fig. 23.)
Rhizonubecula gen. nov., LeCalvez, **198,** p. 96. Generotype *R. adherens* LeCalvez, 1935. Fam. Ophthalmidiidae, subfam. Nubeculariinae. Mediterranean Sea, 7 to 10 m.
——— *adherens* LeCalvez, **198,** p. 96, text fig. xi. Recent, Mediterranean Sea, 7 to 10 m.
Robulus barbati Cushman and Hobson, **71,** p. 57, pl. 8, fig. 9. Oligocene?, California. (For *R. politus* Barbat and von Estorff, 1933, not Schwager, 1866, *Jour. Paleontology*, vol. 7, p. 168, pl. 23, fig. 17.)
——— sp.(?) Cushman and Hobson, **71,** p. 56, pl. 8, fig. 7. Oligocene?, California.
——— n. sp. 1 Eichenberg, **100,** p. 5, pl. 3, fig. 10. Aptian, Germany.
——— n. sp. 2 Eichenberg, **100,** p. 7. pl. 5, fig. 11. Aptian, Germany.
——— sp. Eichenberg, **100,** p. 6, pl. 4, fig. 9. Aptian, Germany.
——— sp. Eichenberg, **100,** p. 6, pl. 4, fig. 1. Aptian Germany.
——— sp. Eichenberg, **101,** p. 396, pl. 8, fig. 5. Lower Neocomian, northern Germany.
Rotalia indopacifica Thalmann, **319,** p. 605. Plio-pleistocene and Recent, Java. (For *R. schroeteriana* Cushman, 1921, not Parker and Jones, 1862, *U. S. Nat. Mus., Bull.* 100, vol. 4, p. 347, pl. 73, fig. 1.)
——— sp.? Cushman, **60,** p. 46, pl. 19, fig. 11. Upper Eocene, Florida.
——— sp. Dietrich, **89,** p. 81, text figs. 4–8. Upper Cretaceous, Colombia, S. A.
——— *viennoti* Greig, **130,** p. 524, pl. 58, figs. 1–14. Oligocene, Palestine.

Saccammina fragilis LeCalvez, **198,** p. 87, text fig. vi. Recent, Mediterranean Sea, 200 m.
Saccodendron gen. nov., Rhumbler, **258,** p. 173, Generotype: *S. heronalleni* Rhumbler, 1935. Fam. Rhabdamminidae, subfam. Astrorhizinae. Recent, Bay of Kiel, Germany.
——— *heronalleni* Rhumbler, **258,** p. 174. Recent, Bay of Kiel, Germany. (For *Dendrophrya radiata* Str. Wright, in Möbius, 1889, not H. B. Brady, 1884, *Arch. f. Naturgesch.*, vol. 56, p. 13, pl. 2, figs. 22–27.) This new species consists of the following two new forms:
——— ———, Rhumbler forma *latericium* Rhumbler, **258,** p. 175, text figs. 102–104. Recent, Bay of Kiel, Germany.
——— ——— Rhumbler, forma *limosum* Rhumbler, **258,** p. 175, text fig. 105. Recent, Bay of Kiel, Germany.
?*Saracenaria* n. sp. 1 Eichenberg, **100,** p. 9, pl. 4, fig. 3. Aptian, northern Germany.
?——— n. sp. 2 Eichenberg, **100,** p. 10, pl. 4, fig. 4. Aptian, northern Germany.
——— *schencki* Cushman and Hobson, **71,** p. 57, pl. 8, fig. 11. Oligocene ?, California.
——— *spinosa* Eichenberg, **100,** p. 10, pl. 4, fig. 5. Aptian, northern Germany.
Schubertella sp. Gubler, **131,** p. 76, pl. 2, fig. 3. Permian, Indochina.
Schultzella stercomifera Rhumbler, **258,** p. 148, text figs. 9, 10. Recent, Bay of Kiel, Germany.
Schwagerina fosteri Thompson and Miller, **328,** p. 650, pl. 79, figs. 1–7. Permian, western China.
Silicotextulina deflandrei Frenguelli, **117,** p. 116, text fig. 1. Recent, Puerto de San Blas, Buenos Aires, Argentine.
Siphogaudryina subgen, nov., Cushman, **62,** p. 3. Subgenerotype: *Gaudryina stephensoni* Cushman, 1928, *Cushman Lab. Foram. Research, Contr.*, vol. 4, p. 108, pl. 16, figs. 6–8. Upper Cretaceous, U.S.A., and Recent, West Indies. New subgenus of *Gaudryina* d'Orbigny, 1839.
Spandelina cavernula Paalzow, **240,** p. 35, pl. 4, fig. 4. Permian, Germany.
——— *thuringica* Paalzow, **240,** p. 35, pl. 4, fig. 5. Permian, Germany.
Spandelinoides sparsicostus Paalzow, **240,** p. 36, pl. 4, fig. 13. Permian, Germany.
Spirillina vicksburgensis Cushman, **64,** p. 34, pl. 5, fig. 6. Lower Oligocene, Mississippi.
Spirolina arrecta Cushman, **64,** p. 27, pl. 4, fig. 7. Lower Oligocene, Mississippi.
——— *navarroi* Colom Casasnovas, **52,** p. 93, pl. 13, figs. 1–4. Recent, Baleares Islands, Spain.
Spiroloculina bidentata Hadley, **133,** p. 191, pl. 1, fig. 4. Upper Eocene, Mississippi.
——— sp.? Cushman, **60,** p. 14, pl. 4, fig. 1. Upper Eocene, Mississippi.
——— *subaequalis* Parr, **243,** p. 85, pl. 20, figs. 5, 6, text fig. 2. Miocene, New Zealand.
Spiroplectammina adamsi Lalicker, **193,** p. 39, pl. 6, fig. 1. Eocene, California.
——— *alexanderi* Lalicker, **192,** p. 1, pl. 1, fig. 1. Lower Cretaceous, Texas.
——— *chicoana* Lalicker, **192,** p. 7, pl. 1, figs. 8, 9. Upper Cretaceous, California. (For *S. anceps* Cushman and Church, 1929, not Reuss, 1845, *California Acad. Sci., Proc.*, 4th ser., vol. 18, p. 500, pl. 36, figs. 1, 2.)

——— *gaultana* Lalicker, **192,** p. 8, pl. 2, figs. 1, 2. Middle Cretaceous, Gault, England. (For *Textularia praelonga* Chapman, 1892, not Reuss, 1846, *Royal Micr. Soc., Jour.*, p. 329, pl. 6, fig. 23, and for *Spiroplecta biformis* Burrows, Sherborn and Bailey, 1890, not Parker and Jones, 1865, *Royal Micr. Soc., Jour.*, p. 554, pl. 8, fig. 21.)

——— *goodlandana* Lalicker, **192,** p. 2, pl. 1, figs. 2, 3. Lower Cretaceous, Texas.

——— *longa* Lalicker, **192,** p. 3, pl. 1, figs. 4, 5. Lower Cretaceous, Texas.

——— *mexiaensis* Lalicker, **193,** p. 43, pl. 6, figs. 5, 6. Eocene, Midway formation, Texas.

——— *nuda* Lalicker, **192,** p. 4, pl. 1, figs. 6, 7. Lower Cretaceous, Texas.

——— *nuttalli* Lalicker, **193,** p. 43, pl. 6, figs. 3, 4. Upper Eocene, Venezuela. (For *Textularia* aff. *pala* Nuttall, 1935, not Czjzek, 1848, *Jour. Paleontology*, vol. 9, p. 123, pl. 14, fig. 4.)

——— *roemeri* Lalicker, **192,** p. 9, pl. 2, fig. 5. Cretaceous, Germany. (For *Textularia laevis* Roemer, 1840, not Ehrenberg, 1838, *Verst. Norddeutsch. Kreide*, p. 97, pl. 15, fig. 17, and for *Spiroplectammina laevis*, Cushman, *Cushman Lab. Foram. Research, Contr.*, vol. 8, p. 87, pl. 11, fig. 2.)

——— *senonana* Lalicker, **192,** p. 9, pl. 2, figs. 3, 4. Upper Cretaceous, Senonian, Germany.

——— *sigmoidina* Lalicker, **192,** p. 7, pl. 1, figs. 10, 11. Upper Cretaceous, California.

Staffella atokensis Thompson, **325,** p. 117, pl. 13, figs. 6–10. Lower Pennsylvanian, Oklahoma.

——— *hollingsworthi* Thompson, **325,** p. 119, pl. 13, figs. 1–5. Lower Pennsylvanian, Oklahoma.

——— *keytei* Roth and Skinner, 1930, var. *maccoyensis* Thompson, **325,** p. 118, pl. 13, figs. 11–15. Lower Pennsylvanian, Oklahoma.

——— *moellerana* Thompson, **325,** p. 113, pl. 13, figs. 19–23. Upper Carboniferous, Armenia. (For *Fusulinella sphaerica* Abich in v. Moeller, 1878, *Imp. Acad. Sci. St. Pétersbourg, Mém.*, ser. 7, vol. 25, no. 9, p. 114, pl. 5, fig. 6; pl. 15, fig. 3.) (Note: This species is preoccupied by *S. moelleri* Ozawa, 1925. See Editor's note, p. 208.)

Textularia anglica Lalicker, **192,** p. 10, pl. 2, figs. 6, 7. Middle Cretaceous, Gault, England. (For *T. gramen* Burrows, Sherborn and Bailey, 1890, not d'Orbigny 1846, *Royal Micr. Soc., Jour.*, p. 553, pl. 8, fig. 13.)

——— *badenensis* Lalicker, **193,** p. 44, pl. 7, fig. 1. Miocene, Austria. (For *T. partschii* Czjzek, 1848, not Reuss, 1846, *Haidinger's Naturwiss. Abh.*, vol. 2, p. 148, pl. 13, figs. 22–24.)

——— *bartonana* Lalicker, **193,** p. 44, pl. 7, fig. 6. Upper Eocene, Italy.

——— *calva* Lalicker, **191,** p. 1, pl. 1, figs. 1, 2. Recent, Puerto Rican deep, 240 to 300 fathoms.

——— *chapmani* Lalicker, **192,** p. 13, pl. 2, figs. 8, 9. Middle Cretaceous, Gault, England. (For *T. conica* Chapman, 1892, not d'Orbigny, 1839, *Royal Micr. Soc., Jour.*, p. 329, pl. 6, fig. 20.)

——— *dollfussi* Lalicker, **193,** p. 45, pl. 7, figs. 8, 9. Miocene, France. (Note : the species name should be written "*dollfusi*.")

——— *halkyardi* Lalicker, **193,** p. 45, pl. 7, fig. 5. Upper Eocene, France. (For *T. agglutinans* Halkyard, 1919, not d'Orbigny, 1839, *Manchester Lit. Philos. Soc., Mem. and Proc.*, vol. 62, p. 31.)

——— *lajollaensis* Lalicker, **193,** p. 46, pl. 6, fig. 13. Eocene, California. (For *T. labiata* Reuss var., in Cushman and M. A. Hanna, 1927, *San Diego Soc. Nat. History, Trans.*, vol. 5, p. 50, pl. 4, fig. 3.)

——— *lateralis* Lalicker, **191,** p. 2, pl. 1, figs. 3–5. Recent, Puerto Rican deep, 240 to 300 fathoms.

——— *lontensis* Lalicker, **193,** p. 49, pl. 7, figs. 2, 3. Upper Eocene, Italy.

——— *midwayana* Lalicker, **193,** p. 49, pl. 6, figs. 7–9. Eocene, Midway formation, Texas.

——— *ovulata* Lalicker, **193,** p. 50, pl. 6, figs. 11, 12. Miocene, France. [For *T. rugosa* d'Orbigny, in Fornasini, 1901, *Riv. italiana paleontologia*, vol. 7, p. 105, pl. 3, fig. 3, and for *T. rugosa* d'Orbigny, 1826, not Reuss, 1869 (= *Plecanium*), *Annales sci. nat.*, vol. 7, no. 262.]

——— *plummerae* Lalicker, **193,** p. 50, pl. 6, fig. 10. Eocene, Midway formation, Texas. [For *T. eocaena* Plummer, 1926, not Gümbel, 1868, (= *Plecanium*), *Univ. Texas, Bull.* 2644, p. 67, pl. 3, fig. 2.]

——— *suttonensis* Lalicker, **193,** p. 51, pl. 7, fig. 4. Lower Pliocene, England. [For *T. sulcata* Jones, 1897, not Ehrenberg, 1854, *Crag. Foram., Pal. Soc. London*, 1895 (1897), p. 146, pl. 5, fig. 20.]

——— *thanetana* Lalicker, **193,** p. 51, pl. 7, fig. 7. Lower Eocene, England. (For *T. sagittula* Burrows and Holland, 1897, not Defrance, 1824, *Geol. Assoc. London, Proc.*, vol. 15, p. 31, pl. 2, fig. 10.)

Tholosina bulla (H. B. Brady, 1881) forma *appressa* Rhumbler, **258,** p. 165, text fig. 66. Recent, Bay of Kiel, Germany.

——— *centroforata* Rhumbler, **258,** p. 164, text figs. 61, 62. Recent, Bay of Kiel, Germany.

——— *margineforata* Rhumbler, **258,** p. 163, text fig. 60. Recent, Bay of Kiel, Germany.

Triloculina fenimorei Cushman, **62,** p. 6, pl. 2, figs. 4, 5. Recent, off north of Puerto Rico, 33 to 40 fathoms.

——— *mississippiensis* Cushman, **64,** p. 25, pl. 4, fig. 1. Lower Oligocene, Mississippi.

——— *nasuta* Cushman, **62,** p. 5, pl. 2, figs.

1–3. Recent, off north of Puerto Rico, 33 to 40 fathoms.
——— sp.? Cushman, **60,** p. 15, pl. 4, fig. 4. Upper Eocene, Mississippi.
——— *vigueresi* Bermúdez, **17,** p. 168, pl. 12, figs. 8, 9. Recent, north coast, Cuba.
Triplasia somaliensis Macfadyen, **211,** p. 11, pl. 1, fig. 7. Jurassic, Argovian?, British Somaliland, Africa.
Tritaxilina colei Cushman and Siegfus, **74,** p. 92, pl. 14, figs. 5, 6. Upper Eocene, Chapopote formation, Mexico.
Trybliolepidina see *Lepidocyclina*

Unicosiphonia gen. nov., Cushman, **65,** p. 81. Generotype: *U. crenulata* Cushman, 1935. Family not given. Late Tertiary, New England.
——— *crenulata* Cushman, **65,** p. 81, pl. 12, figs. 9, 10. Late Tertiary, New England.
Uvigerina ampullacea H. B. Brady, 1884, var. *ampullacea* Campbell, **39,** p. 44, text fig. iv. Recent, Pacific, Easter Island. (This variety is preoccupied by *U. asperula* Czjzek, 1847, var. *ampullacea* H. B. Brady, 1884, *Challenger Rept., Zoology,* vol. 9, p. 579, pl. 75, figs. 10, 11.)
——— ——— H. B. Brady, var. *nuda* Campbell, **39,** p. 42, text fig. iii. Recent, Pacific, Easter Island. [This variety is preoccupied by *U. nuda* Terquem, 1882, *Soc. géol. France, Mém.*, 3d ser. vol. 2, p. 120, pl. 12 (20), fig. 31.]
——— *cookei* Cushman, **60,** p. 39, pl. 15, figs. 14–16. Upper Eocene, Alabama.

Vaginulina aptiensis Eichenberg, **100,** p. 27, pl. 5, fig. 5. Aptian, northern Germany.
——— *biochei* Berthelin, 1880, var. *elongata* Eichenberg, **100,** p. 26, pl. 5, fig. 4. Aptian, northern Germany. [This variety is preoccupied by ? *Vaginulina elongata* Roemer, 1841, and by *Vaginulina elongata* d'Orbigny, 1849. (= *Planularia* d'Orbigny, 1826.)]
——— *kummi* Eichenberg, **100,** p. 25, pl. 5, fig. 1. Aptian, northern Germany.
——— *minor* Eichenberg, **100,** p. 28, pl. 7, fig. 8. Aptian, northern Germany.
——— n. sp. Eichenberg, **101,** p. 398, pl. 13, fig. 13. Hauterivian, northern Germany.
——— n. sp. 1 Eichenberg, **100,** p. 26, pl. 5, fig. 3. Aptian, northern Germany.
——— n. sp. 2 Eichenberg, **100,** p. 27, pl. 5, fig. 6. Aptian, northern Germany.
——— sp.(?n. sp.) Eichenberg, **100,** p. 27, pl. 5, fig. 8. Aptian, northern Germany.
Valvulineria georgiana Cushman, **65,** p. 82, pl. 12, fig. 17. Late Tertiary, New England.
——— *paucilocula* Cushman, **64,** p. 37, pl. 5, fig. 7. Lower Oligocene, Mississippi.
——— *sculpturata* Cushman, **64,** p. 37, pl. 5, fig. 10. Lower Oligocene, Mississippi.
Vanhoeffenella gaussi Rhumbler, 1905, forma *imperfecta* Rhumbler, **258,** p. 170, text fig. 81. Recent, Bay of Kiel, Germany.
Verneuilina sp.(?) Cushman and Hobson, **71,** p. 56, pl. 8, fig. 6. Oligocene?, California.
——— *spiculotesta* Cushman, **62,** p. 2, pl. 1, figs. 7, 8. Recent, off north of Puerto Rico, 350 to 400 fathoms.
Vulvulina curta Cushman and Siegfus, **74,** p. 91, pl. 14, figs. 1, 2. Upper Eocene?, Kreyenhagen shale, California.

Webbinella crassa LeCalvez, **198,** p. 90, text fig. viii. Recent, Mediterranean Sea, 6 m.
——— *earlandi* Rhumbler, **258,** p. 159, text figs. 54, 55. Recent, Bay of Kiel, Germany.

Yangchienia tobleri Thompson, **327,** p. 516, pl. 17, figs. 1, 2, 7. Middle Permian, Greece. (For *Fusulinella* sp. Ozawa and Tobler, 1929, *Eclogae geol. Helvetiae*, vol. 22, p. 47, pl. 5, fig. 3, and for *Fusulinella bocki* Silvestri, 1933, *Geol. R. Univ. Padova, Mem. Inst.*, vol. 10, p. 31, pl. 2, fig. 7; pl. 3, fig. 6.)

NOMINA NUDA

The following *nomina nuda* were recorded in the literature of Foraminifera for the year 1935:

Iridia lucida LcCalvez, **197,** p. 1505. (Only a figure of the gamete of this new species is given, namely text fig. 2, magnified 6000×.)
Miliolina dictifusiformis Văscăutanu, in Macarovici and Văscăutanu, **210,** p. 416. Miocene of Roumania.
Truncatulina elegans Văscăutanu, in Macarovici and Văscăutanu, **210,** p. 418. Tortonian, Miocene, Jassy, Roumania.

SUPPLEMENTS TO INDEX OF NEW GENERA, SPECIES AND VARIETIES OF FORAMINIFERA FOR THE YEARS 1931–1934

The following new genera and species should be added to the respective Indexes of new forms of Foraminifera for the years 1931 to 1934:

1931: Astrolepidina subgen. nov., Silvestri, 1931, *Riv. italiana paleontologia*, vol. 37, p. 35. New subgenus for the stellate forms of the genus *Lepidocyclina* Gümbel, 1868.

Chapmanina *nomen mutatum* Silvestri. 1931, *Soc. geol. italiana, Boll.*, vol. 50, p. 65. The new name replaces *Chapmania* Silvestri and Prever, 1904, because this generic name is preoccupied by Monticelli, 1893, for a Cestode. Hence, Galloway's family Chapmaniidae, 1933, *A Manual of Foraminifera*, p. 316, is herewith changed accordingly to **Chapmaninidae** *nomen mutatum.*

1932: *Fusulina wilsoni* Galloway and White, 1932, *Univ. Texas, Bull.* 3211, p. 102, (explanation to pl. 9, but without description), pl. 9, figs. 4, 5. Pennsylvanian, Dornick Hills formation, Oklahoma.

1933: *Haplophragmoides inaequilateralis* Subbotina, 1933. This new species, which possibly may be a *nomen nudum*, is cited in Voloshinoff, 1935, *The Petroleum Industry*, Moscow, vol. 29, no. 10, p. 37, from the Pliocene of Sakhalin Island, but originally is described from the Maikop region.

——— *peripheroexcavata* Subbotina, 1933, in Voloshinoff, **335**, p. 37. Pliocene of Sakhalin Island, but originally described from the Maikop region.

———*peripherosulcata* Subbotina, 1933 (or 1934?), in Voloshinoff, **335**, p. 36. Miocene of Sakhalin Island.

1934: *Assilina exponens-granulosa* Caudri, 1934, *Tertiary Deposits of Soemba*, Amsterdam, p. 35, pl. 1, figs. 1, 2. Lower Eocene, Soemba Island, Dutch East Indies.

Cristellaria oolithica Schwager, 1867, var. *orthonota* Kasanzev, **411**, p. 19, pl. 4, fig. 37. Jurassic, Emba Region, U.S.S.R.

Marginulina casacstanica Kasanzev, **411**, p. 21, pl. 5, figs. 40, 41, 46; pl. 6, fig. 52. Jurassic, Emba region, U.S.S.R.

There should be added, furthermore, the following new taxonomic units, created during 1934:

Ammodiscoidea superfam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 556.

Cancrisinae subfam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Sci.*, vol. 38, no. 262, p. 567. New subfamily of Rotaliidae.

Cibicididae fam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 570.

Cornuspiridae fam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 556.

Discorbisinae subfam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 560. New subfamily of Rotaliidae.

Lenticulinidae fam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 554.

Lenticulininae subfam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 554. New subfamily of Lenticulinidae.

Melonidae fam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 556.

Polytremidae fam. nov., Chapman and Parr, *Linnean Soc. Jour., Zoology*, vol, 38, no. 262, p. 573. (Note: The genus name *Polytrema* has recently been changed by Galloway to *Miniacina*. The new family should, therefore, be named **Miniacinidae** fam. nov.)

Schubertellinae subfam. nov., Doutkevich, 1934, *Geol. Petrol. Inst. Moscow-Leningrad, Mem.*, (A), vol. 55, p. 3. New subfamily of Fusulinidae, including the genera *Schubertella* Staff and Wedekind, 1910, *Fusiella* Lee and Chen, 1930, and *Boultonia*, Lee, 1927.

Spirillinoidea superfam. nov., Chapman and Parr, 1934, *Linnean Soc. Jour., Zoology*, vol. 38, no. 262, p. 554.

HANS E. THALMANN, REGENTESSELAAN 7, PALEMBANG, SUMATRA. MANUSCRIPT RECEIVED BY THE EDITOR, AUGUST 1, 1937.

EDITOR'S NOTE: Careful reading of the Rules cited by Dr. Thalmann concerning homonyms fails to support his conclusions that *Bolivina cubana* Bermudez is a homonym of *B. lobata cubensis* Cushman, and that *Staffella moellerana* Thompson is a homonym of *S. moelleri* Ozawa. Mrs. Helen Jeanne Plummer, who has contributed her aid in editorial reading of this and previous indices prepared by Dr. Thalmann, agrees with this opinion of the Editor. It appears clear to us that the names given by Bermudez and Thompson in the cases cited are entirely valid, despite their derivation from the same source as earlier published terms.

SOCIETY RECORDS AND ACTIVITIES

MEMBERS OF THE SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS

*ADAMS, BRADFORD C., Room 715, 929 South Broadway, Los Angeles, California

ADAMS, JOHN EMERY, Drawer R, Midland, Texas

*ALBRITTON, CLAUDE C., JR., Southern Methodist University, Dallas, Texas

*ALEXANDER, A. E., Buffalo Museum of Science, Buffalo, New York

ALEXANDER, C. I., Magnolia Petroleum Company, Lake Charles, Louisiana

ANDERSON, FRANK MARION, 58 Hillcrest Road, Berkeley, California

*APPLIN, ESTHER R., 2212 Mistletoe Blvd., Fort Worth, Texas

ARICK, MILLARD B., Lago Petroleum Corporation, Maracaibo, Venezuela, S. A.

*ARTUSY, RAY, Associated Oil Company, Ventura, California

BAKER, WILLIAM A., JR., Huasteca Petroleum Company, Tampico, Tamps., Mexico

*BALL, JOHN RICE, Northwestern University, Evanston, Illinois

BARBAT, WILLIAM F., Standard Oil Company, Taft, California

*BARKER, REGINALD W., Apartado 150, Tampico, Tamps., Mexico

*BARNES, SYDNEY U., 3520 S. Hoover Blvd., Los Angeles, California

BARTON, DONALD C., Humble Oil and Refining Company, Houston, Texas

*BASSLER, R. S., U. S. National Museum, Washington, D. C.

BAY, HARRY X, 216 College Street, Sulphur Springs, Texas

BELL, FRANK W., Shell Petroleum Company, Long Beach, California

*BERMUDEZ, PEDRO J., University of Havana, Havana, Cuba

BERNOULLI, W., 57 Sissacherstrasse, Basle, Switzerland

*BLAKE, CHARLES H., Massachusetts Institute of Technology, Cambridge, Massachusetts

*BOWLES, EDGAR O., Johns Hopkins University, Baltimore, Maryland

BRADFIELD, H. H., The Texas Company, Fort Worth, Texas

BRANSON, E. B., University of Missouri, Columbia, Missouri

BRAUNSTEIN, JULES, Shell Petroleum Corporation, Houston, Texas

BRAVINDER, KENNETH M., 725 E. Bixby Road, Long Beach, California

*CALDWELL, LOREN A., Northern Illinois State Teachers College, De Kalb, Illinois

CAMPBELL, ROBERT B., 602 Wallace S. Building, Tampa, Florida

CANFIELD, CHARLES R., Union Oil Company, Orcutt, California

*CHAMBERS, JACK, Union Producing Company, Houston, Texas

CHENEY, M. G., P. O. Box 446, Coleman, Texas

CHURCH, CLIFFORD C., 79 New Montgomery Street, San Francisco, California

CLARK, J. W., Magnolia Petroleum Company, Dallas, Texas

COHEE, GEORGE V., University of Illinois, Urbana, Illinois

*COOMBS, HOWARD A., University of Washington, Seattle, Washington

CORYELL, HORACE N., Columbia University, New York City

COX, BEN BURTON, 26 Broadway, New York City

CRAM, Ira H., Pure Oil Company, Tulsa, Oklahoma

CRUSE, JOHN S., JR., Amerada Petroleum Corporation, Houston, Texas

CUSHMAN, JOSEPH A., 76 Brook Road, Sharon, Massachusetts

DECKER, CHARLES E., University of Oklahoma, Norman, Oklahoma

DE GOLYER, E., 611 Continental Building, Dallas, Texas

*DENHAM, RICHARD L., Humble Oil and Refining Company, Midland, Texas

DEUSSEN, ALEXANDER, 1006 Shell Building, Houston, Texas
DICKERSON, ROY E., 260 S. Broad Street, Philadelphia, Pennsylvania
DONOGHUE, DAVID, Fort Worth National Bank Building, Fort Worth, Texas
DORR, JAMES B., Shell Petroleum Corporation, Houston, Texas
DRIVER, HERSCHEL L., 630 W. Palm Drive, Glendale, California
*DUNBAR, CARL O., Yale University, New Haven, Connecticut
DUNBAR, CLARENCE P., 810 Orleans Street, New Orleans, Louisiana
DURGAN, HERBERT L., Sun Oil Company, Beaumont, Texas
*DUSENBURY, A. N., 24 Hillside Avenue, White Plains, New York
EDWARDS, EVERETT C., 410 Professional Building, Bakersfield, California
ELLIS, ALBERT D., Stanolind Oil and Gas Company, Houston, Texas
*ELLIS, BROOKS FLEMING, New York University, New York City
ELLISOR, ALVA C., Humble Oil and Refining Company, Houston, Texas
*EMBLICH, JOHN R., Cavalry School, Fort Riley, Kansas
*EMEIS, J. D., Bataafsche Petr. Mij., Balihpapan Borneo, D. E. I.
FABIANI, RAMIRO, Universita di Palermo, Palermo, Italy
FERGUSON, GLENN C., Union Oil Company, Los Angeles, California
FERGUSON, H. C., 415 Esperson Building, Houston, Texas
FERGUSON, KENNETH H., 410 Esperson Building, Houston, Texas
FETTKE, CHARLES R., 1118 Wightman Street, Pittsburgh, Pennsylvania
*FISHER, LLOYD W., 59 Franklin Street, Lewiston, Maine
FLAGLER, C. W., Colombian Petroleum Company, Cucuta, Colombia, S. A.
*FORREST, LESH, Stanford University, California
*FRITZ, EDWARD B., 358 Nineteenth Street, Santa Monica, California
GALLOWAY, JESSE J., University of Indiana, Bloomington, Indiana
GARDNER, JULIA, U. S. Geological Survey, Washington, D. C.
GARRETT, J. B., Stanolind Oil and Gas Company, Houston, Texas
GETZENDANER, F. M., 423 North Park Street, Uvalde, Texas
GILES, ALBERT W., University of Arkansas, Fayetteville, Arkansas
*GILL, J. P., Box 978, Ardmore, Oklahoma
GILL, WILLARD, Box 506, Olney, Illinois
GLENN, LEONIDAS C., Vanderbilt University, Nashville, Tennessee
*GOOCH, D. D., Louisiana State University, University, Louisiana
GOUDKOFF, PAUL P., 799 Subway Terminal Building, Los Angeles, California
GRANT, U. S., IV, University of California, Los Angeles, California
*GRAVELL, DONALD W., 2309 Huldy Street, Houston, Texas
GREEN, GUY E., 2176 W. Summit, San Antonio, Texas
GREENE, FRANK C., 900 East 9th Street, Kansas City, Missouri
GRILEY, HORACE L., Sun Oil Company, Mattoon, Illinois
GRIMSDALE, T. F., Apartado 150, Tampico, Tamps., Mexico
*GULLY, PHILLIP D., Box 1024, Beeville, Texas
HALBOUTY, M. T., Merit Oil Corporation, Houston, Texas
HAMILL, JAMES M., Box 1640, Los Angeles, California
HAMILTON, C. E., 1916 North Drexel Street, Oklahoma City, Oklahoma
HANNA, G. DALLAS, Associated Oil Company, San Francisco, California
HANNA, MARCUS A., Box 2100, Houston, Texas
HARLTON, BRUCE H., Amerada Petroleum Corporation, Tulsa, Oklahoma
*HARRIS, REGINALD W., University of Oklahoma, Norman, Oklahoma
HASSELMANN, KARL F., 1912 Esperson Building, Houston, Texas
HAWKINS, GLENN D., 423 S. Allegheny Avenue, Tulsa, Oklahoma
*HAWKINS, HAROLD H., 1757 N. Street, NW., Washington, D. C.
HAZZARD, ROY T., P. O. Box 1731, Shreveport, Louisiana

HEDBERG, HOLLIS D., Apartado 35, Ciudad Bolivar, Venezuela, S. A.
HENBEST, LLOYD G., U. S. Geological Survey, Washington, D. C.
*HENDERSON, MRS. DOSKA M., Box 1328, Houston, Texas
*HENDRICKS, JOHN A., 6796 Milner Road, Hollywood, California
*HIBBARD, RAYMOND R., 219 Bissell Avenue, Buffalo, New York
HILL, ROBERT T., Jefferson Hotel, Dallas, Texas
HOLDEN, R. J., Virginia Polytechnic Institute, Blacksburg, Virginia
HOLLAND, LAURIER F. S., 1768 North La Brea Avenue, Hollywood, California
HONESS, CHARLES W., Gulf Oil Corporation, Wichita, Kansas
HOOVER, W. F., University of Illinois, Urbana, Illinois
HORNBERGER, JOSEPH, JR., 2240 Inwood Drive, Houston, Texas
*HOUGH, JACK LUIN, University of Chicago, Chicago, Illinois
HOWE, HENRY V., Louisiana State University, University, Louisiana
*HOWELL, B. F., Princeton University, Princeton, New Jersey
HUGHES, DONALD D., 1718 El Rito Avenue, Glendale, California
HUTSON, E. B., Standard Oil Company of Louisiana, Shreveport, Louisiana
ISRAELSKY, MERLE C., United Gas Corporation, Houston, Texas
JABLONSKI, EUGENE, Deutsche Vacuum Oel Ak., Hamburg, Germany
*JAMISON, CLAUDE T., 201 Chicago Blvd., San Antonio, Texas
JANOVY, JOHN, Louisiana Land and Exploration Company, Houma, Louisiana
JOHNSON, F. W., Lago Petroleum Corporation, Maracaibo, Venezuela, S. A.
JOHNSON, J. HARLAN, P. O. Box 336, Golden, Colorado
JOHNSON, SAMUEL C., Columbia University, New York City
*JOHNSON, WILLIAM R., State Geological Survey, Lincoln, Nebraska
*JONES, BRADFORD C., 205 Avenue F, Redondo Beach, California
*JORDAN, LOUISE, 173 West Delason Avenue, Youngstown, Ohio
KAUFMANN, GODFREY F., Standard Oil Company of Venezuela, Caripito, Venezuela
KAY, G. MARSHALL, Columbia University, New York City
KEMP, AUGUSTA HASSLOCK, Seymour Public Schools, Seymour, Texas
KILIAN, H. M., 942 W. 34th Street, Los Angeles, California
*KINDLE, E. M., 33 Woodlawn, Ottawa, Ontario, Canada
*KING, RALPH H., P. O. Box 1589, Dallas, Texas
KING, ROBERT EVANS, Shell Petroleum Company, Midland, Texas
KLEINPELL, ROBERT M., P. O. Box 62, Bakersfield, California
KNIGHT, J. BROOKES, Princeton University, Princeton, New Jersey
KNIKER, MISS HEDWIG T., Alamo National Building, San Antonio, Texas
KOCH-LAMBERT, RICHARD E., 30 Carel van Bylandtlaan, The Hague, Holland
*KRUMBEIN, W. C., University of Chicago, Chicago, Illinois
LAIMING, BORIS G., The Texas Company, Los Angeles, California
LALICKER, CECIL G., Phillips Petroleum Company, Corpus Christi, Texas
LEATHEROCK, CONSTANCE, 401 Ambassador Hotel, Tulsa, Oklahoma
*LEE, A. THEODORE, 2716 W. 82nd Street, Inglewood, California
*LIEBUS, ADALBERT, Professor of Paleontology, Vienna 3, Prag, Czechoslovakia
LINK, THEODORE A., Imperial Oil Company, Calgary, Alberta, Canada
*LIPSCOMB, VERNON F., Pure Oil Company, Fort Worth, Texas
*LOEBLICH, ALFRED R., 452 College Avenue, Norman, Oklahoma
*LUCAS, ELMER L., Oklahoma University Station, Enid, Oklahoma
LUGN, ALVIN L., University of Nebraska, Lincoln, Nebraska
LYNCH, S. A., North Texas Agricultural College, Arlington, Texas
MACFADYEN, W. A., Longships, Capelle-Ferne, Folkestone, England
MACNAUGHTON, LEWIS W., 611 Continental Building, Dallas, Texas

MADDOX, GERALD C., Box 431, Ponca City, Oklahoma
*MALKIN, DORIS S., 157 97th Street, Brooklyn, New York
MANGER, G. E., Apartado 234, Maracaibo, Venezuela, S. A.
*MARTIN, LOIS T., 2154 Cedar Avenue, Long Beach, California
MAXWELL, RILEY GLENN, 1942 S. 7th, Abilene, Texas
MAY, ARTHUR R., Shell Oil Company, Los Angeles, California
MAY, GEORGE N., Sulphur, Louisiana
*MILLER, A. K., Iowa State University, Iowa City, Iowa
MILLER, GUY EDWIN, 205 Professional Building, Long Beach, California
*MILLS, LLOYD C., Box 385, Odessa, Texas
MINTON, J. W., Sun Oil Company, McAllen, Texas
MISER, HUGH D., U. S. Geological Survey, Washington, D. C.
MONSOUR, ELI T., Cia. de Petroleo Mercedes, Tampico, Tamps., Mexico
MOORE, RAYMOND C., University of Kansas, Lawrence, Kansas
MOORE, WILLIAM B., Atlantic Oil and Refining Company, Houston, Texas
*MOREMAN, W. L., Magnolia Petroleum Company, Oklahoma City, Oklahoma
*MOREY, PHILIP S., Shell Petroleum Corporation, Houston, Texas
MORGAN, CHARLES GILL, 168 North Hill Avenue, Pasadena, California
MORNHINVEG, A. R., United Gas System, Houston, Texas
MORRISON, T. E., Humble Oil and Refining Company, Houston, Texas
*MORROW, A. LYNDON, Magnolia Petroleum Corporation, Wichita, Kansas
MOSES, H. F., Carter Oil Company, Tulsa, Oklahoma
MUELLER, FREDERICK W., 1301 Esperson Building, Houston, Texas
MUELLERRIED, FREDERICO K. G., 2a del Volga 18, Mexico, D. F.
*NADEAU, BETTY KELLETT, 510 W. 6th Street, Topeka, Kansas
NEEDHAM, C. E., New Mexico School of Mines, Socorro, New Mexico
NEILL, W. B., Stanolind Oil and Gas Company, Houston, Texas
*NEWELL, NORMAN D., University of Wisconsin, Madison, Wisconsin
NOMLAND, J. O., 160 Bell Avenue, Piedmont, California
*NUTTALL, W. L. F., Bataafsche Petr. Mij., The Hague, Holland
OLSSON, AXEL A., 48 Woodside Avenue, Gloversville, New York
OWENS, FRITH CRAVENS, Drawer 30, Corpus Christi, Texas
*PALMER, MRS. DOROTHY, Neptuno 234, Havana, Cuba
PALMER, MRS. KATHERINE V. W., 206 Oak Hill Road, Ithaca, New York
*PARKER, FRANCES, Over-The-Way, 141 Carlton, Brookline, Massachusetts
PATTERSON, JOSEPH M., Box 524, Corsicana, Texas
PATTON, LEROY T., 2415 Nineteenth Street, Lubbock, Texas
*PAYNE, MAX, Box 1442, Bakersfield, California
*PETTIJOHN, F. J., University of Chicago, Chicago, Illinois
PETTY, DABNEY E., Petty Geophysical Engineering Company, San Antonio, Texas
*PFANNKUCHE, MRS. H. C., Pure Oil Company, Fort Worth, Texas
*PIAZ, G. DAL, Via Giotto 20, Padova, Italy
PLUMMER, F. B., University of Texas, Austin, Texas
PONTON, GERALD M., 39 Fullerwood Drive, St. Augustine, Florida
POOR, R. S., Birmingham-Southern College, Birmingham, Alabama
PORCH, EDWIN L., JR., Box 573, San Antonio, Texas
PYEATT, LLOYD M., Box 731, Beeville, Texas
RANKIN, WILBUR D'ARCY, 432 S. Hope Street, Los Angeles, California
REED, E. C., State Geological Survey, Lincoln, Nebraska
REESIDE, JOHN B., JR., Box 177, Hyattsville, Maryland
REITER, WILHELM A., 923 Esperson Building, Houston, Texas
RICE, ELMER M., Box 22 J., Van, Texas

RICHARDS, J. T., P. O. Box 1557, Oklahoma City, Oklahoma
RIES, HEINRICH, Cornell University, Ithaca, New York
RIGGS, ROBERT J., Stanolind Oil and Gas Company, Tulsa, Oklahoma
*RITTENHOUSE, GORDON, U. S. Department of Agriculture, Soil Conservation Service, Albuquerque, New Mexico
*ROBERTS, MARION S., 307 Humble Annex B, Houston, Texas
ROLSHAUSEN, F. W., Humble Oil and Refining Company, Houston, Texas
ROMANS, WILLIAM A., Windsor Oil Corporation, Baton Rouge, Louisiana
ROPER, FRANK CHARLES, 908 Sterling Building, Houston, Texas
ROTH, ROBERT, Humble Oil and Refining Company, Wichita Falls, Texas
RUSSELL, R. D., Louisiana State University, University, Louisiana
*RUTSCH, D. R., Naturhistor. Museum, Basle, Switzerland
RYNIKER, CHARLES, Gulf Oil Corporation, Tulsa, Oklahoma
SAMPLE, CHARLES HURST, Houston Oil Company, Houston, Texas
SANDIDGE, JOHN R., 1704 Alamo National Building, San Antonio, Texas
SASS, LOUIS CARL, Mene Grande Oil Company, Ciudad Bolivar, Venezuela, S. A.
*SCHENCK, HUBERT G., Box 1528, Stanford University, California
SCHUCHERT, CHARLES, Yale University, New Haven, Connecticut
*SCHWEERS, RICHARD H., 4705 Byers, Fort Worth, Texas
SCOTT, GAYLE, Texas Christian University, Fort Worth, Texas
SEASHORE, P. T., Houma, Louisiana
SELIG, A. L., 3350 Wichita, Houston, Texas
SELLARDS, ELIAS H., Bureau of Economic Geology, Austin, Texas
*SENN, ALFRED, British Union Oil Company, Ltd., Barbados, B. W. I.
SHAY, D. C., 707 Petroleum Building, Fort Worth, Texas
SHOENFELT, C. E., Petroleum Information, Inc., Denver, Colorado
SIDWELL, RAYMOND, Texas Technological College, Lubbock, Texas
SIEGFUS, STANLEY S., Box 548, Bakersfield, California
*SIMON, LOUIS J., 10318 La Grange Avenue, Los Angeles, California
*SIMONSON, RUSSELL R., 2215 California Avenue, Bakersfield, California
SMALL, WALT M., 22 Sharia Kasr-El-Nil, Cairo, Egypt
*SMITH, DUDLEY T., Rensselaer Polytechnic Institute, Troy, New York
SMITH, FRED E., Union Producing Company, Houston, Texas
SMITH, LEE CHERRY, Box 2880, Dallas, Texas
SMITH, WAYNE M., Box 46 A, Manhattan Beach, California
SPENCER, MARIA, Box 1106, Midland, Texas
SPIEKER, EDMUND M., Ohio State University, Columbus, Ohio
*SPRAGUE, ROBERT D., 411 Louisiana National Bank Building, Baton Rouge, Louisiana
*STADNICHENKO, TAISIA, U. S. Geological Survey, Washington, D. C.
STAINBROOK, MERRILL A., Texas Technological College, Lubbock, Texas
STAUFFER, CLINTON R., University of Minnesota, Minneapolis, Minnesota
STENZEL, HENRYK B., Bureau of Economic Geology, Austin, Texas
STEPHENSON, LLOYD W., U. S. Geological Survey, Washington, D. C.
STEPHENSON, MORTON B., Box 1990, Fort Worth, Texas
*STEWART, DUNCAN, Michigan State College, East Lansing, Michigan
STILL, J. T., 3 Oak Court, Houston, Texas
STUCKEY, CHARLES W., JR., Stanolind Oil and Gas Company, Houston, Texas
*SUTTON, A. H., University of Illinois, Urbana, Illinois
*SWARTZ, FRANK M., 722 North Atherton, State College, Pennsylvania
TARR, W. A., 704 Westwood Avenue, Columbia, Missouri
TATUM, EMMETT P., 1065 Humble Building, Houston, Texas
TAYLOR, DEWITT E., 1924 Cedar Street, Bakersfield, California

TAYLOR, WILLIAM HARLAN, 315 N. W. 17th Street, Oklahoma City, Oklahoma

THALMANN, HANS E., Regentesselaan 7, Palembang (Sumatra)

THOMAS, N. L., Pure Oil Company, Fort Worth, Texas

*THOMPSON, MARCUS L., Shell Petroleum Corporation, Houston, Texas

THOMPSON, S. A., Magnolia Petroleum Company, Dallas, Texas

*THORP, E. M., Baylor University, Waco, Texas

TIEJE, ARTHUR J., Cordova Hotel, Los Angeles, California

TOMLINSON, CHARLES W., 509 Simpson Building, Ardmore, Oklahoma

TRASK, PARKER D., U. S. Geological Survey, Washington, D. C.

TWENHOFEL, W. H., University of Wisconsin, Madison, Wisconsin

UPP, JERRY E., Box 2040, Tulsa, Oklahoma

UPSON, MARLIN E., Gulf Production Company, Fort Worth, Texas

VAUGHAN, T. WAYLAND, 3333 P Street, Washington, D. C.

*WALDO, A. W., College of the Pacific, Stockton, California

WANLESS, HAROLD R., University of Illinois, Urbana, Illinois

WARTHIN, ALDRED S., Vassar College, Poughkeepsie, New York

WATERS, JAMES ALTON, Sun Oil Company, Dallas, Texas

WEAVER, CHARLES E., University of Washington, Seattle, Washington

WEDEL, ARTHUR, Pure Oil Company, Tulsa, Oklahoma

WEEKS, H. J., 1608 Walnut, Philadelphia, Pennsylvania

WEEKS, WARREN B., Phillips Petroleum Company, El Dorado, Arkansas

WELLER, J. MARVIN, State Geological Survey, Urbana, Illinois

*WELLMAN, DEAN C., 1601 South Carson, Tulsa, Oklahoma

*WENTWORTH, CHESTER K., Honolulu Board of Water Supply, Honolulu, Hawaii

WESTHEIMER, JEROME MAX, 815 3rd Avenue Southwest, Ardmore, Oklahoma

WESTMORELAND, FRANK S., Shell Petroleum Company, Houston, Texas

WEYMOUTH, ANDREW A., 2432 First Avenue North, Seattle, Washington

WHIPPLE, G. LESLIE, 329 E. 19th Street, Long Beach, California

WHITE, MAYNARD PRESSLEY, Gulf Oil Corporation, Ardmore, Oklahoma

*WHITE, R. T., 1923 Bank Street, Bakersfield, California

WHITNEY, F. L., University Station, Austin, Texas

*WICKENDEN, ROBERT T. D., Geological Survey of Canada, Ottawa, Ontario, Canada

*WILLIAMS, JAMES STEELE, U. S. Geological Survey, Washington, D. C.

WILLIAMS, JOHN RAYNESFORD, 801 W. Nevada Street, Urbana, Illinois

WINKLER, Hans, 104 W. 32nd Street, Austin, Texas

WINTON, W. M., Texas Christian University, Fort Worth, Texas

WISSLER, STANLEY G., Box 511, Compton, California

WOMACK, BRAME, 502 Continental Building, Dallas, Texas

WOODFORD, ALFRED O., 443 W. 10th Street, Claremont, California

WRATHER, W. E., 4300 Overhill Drive, Dallas, Texas

* Associate Members

NOTICE TO FELLOWS AND MEMBERS OF THE PALEONTOLOGICAL SOCIETY

At the Washington meeting in December, 1937, the Council of The Paleontological Society voted to cease distributing separates of its Proceedings since these are published as a section of the Proceedings volume of the Geological Society of America. Reprints of the Paleontological section, however, will be sent to members and fellows of The Paleontological Society (when issued, probably in June), if they will send to the Treasurer, R. R. Shrock, Department of Geology, Massachusetts Institute of Technology, Cambridge, Massachusetts, *before May 1*, the sum of fifty cents (stamps or coin) to cover cost of printing and mailing.

ERRATA

The following corrections should be made in the paper by J. Wyatt Durham on "Gastropods of the family Epitoniidae from Mesozoic and Cenozoic rocks of the West Coast of North America," vol. 11, no. 6, pp. 479–512, pls. 56, 57:

In explanation of plate 57, figure 25 should read "*Acrilla* (*Ferminoscala*) *atwoodi* (Dall)," not "*Epitonium atwoodi* Dall."

In explanation of abbreviations, p. 480, "U. W., Washington Univ. Paleont. Coll." should read "U. W., Univ. of Washington, Paleont. Coll."

In the list of references, p. 512, "Bolter, J. F., 1789" should read "Bolten, J. F., 1798." "Koblet, W." should read "Kobelt, W."

DIATOMACEAE

Farlow Reference Library and Herbarium of Crytogamic Botany (Harvard University) is interested in cores, cuttings or outcrops, rich in Diatomaceae.

The library catalogues over 1,000 cleaned specimens from most of the world's classic marine and fresh deposits. Requests for specimens from contributing paleontologists or paleobotanists will be filled so far as available quantities permit.

Specimens will be acid cleaned gratituously and returned to contributor. Address communications to James R. Bartholomew, Research Associate, 35 Clark Street, Brooklyn, New York.

Leitz

ULTROPAK
ILLUMINATOR

is adaptable to practically any microscope stand of standard dimensions.

It permits the observation of paleontological specimens in their natural appearance under low as well as high magnification.

The light source is built in.

A variety of pillar stands is available with facilities for conveniently traversing a large area.

Write for Bulletins Nos. 17-M and 18-M

730 Fifth Ave. **E. LEITZ, Inc.** New York

Washington Chicago Detroit

Western Agents: Spindler & Sauppe, Inc. Los Angeles—San Francisco